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ABSTRACT

This curriculum kit provides students with accurate and up-to-date information on California's forests, forest issues, and forest products in an entertaining and easy to comprehend format. The material in this unit is organized around six lessons, each addressing a different aspect of forest education. Lessons include: (1) "The Web of Life"; (2) "The Nature of Trees"; (3) Nature's Treasure Chest"; (4) "The Sustainable Forest"; (5) "Forest Health"; (6) "Waste Not: Want Not"; and (7) "Forest Families," an enrichment activity provided for the review and reinforcement of concepts illustrated in the entire unit. (CCM)

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FORESTS FOREVER

A FOREST EDUCATION CURRICULUM KIT
ADAPTABLE FOR GRADES K-8

We care for the Forests

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1

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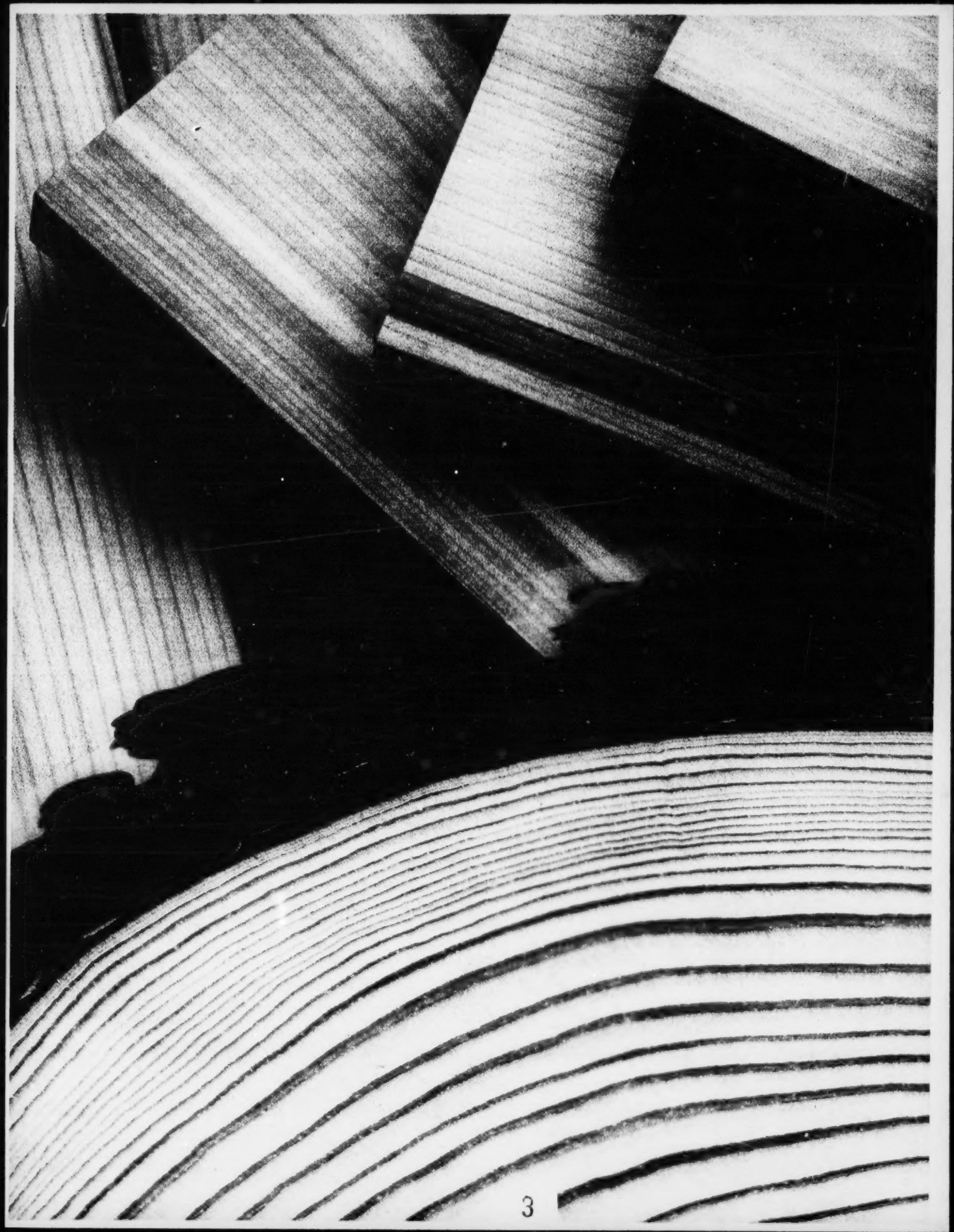

WELCOME!

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To the wonderful world of wood, Mother Nature's renewable, recyclable, biodegradable resource. The California Forest Products Commission has created the environmental education unit on California's forests for your classroom or youth group. It has been structured to comply with California Education Code 8706, which states that students at all levels

> *"...should become aware of the interrelated nature of living processes, gain understanding of ecological relationships, and become sensitive to the interdependence of man and natural resources."*

We hope it will make your job easier and more enjoyable as you strive to provide your students with accurate and up-to-date information on California's forests, forest issues, and forest products in an entertaining and easy to comprehend format. No prior forestry experience is necessary for teaching this unit with ease and success.

The material in this unit is organized around six lessons, each addressing a different aspect of forest education:

THE WEB OF LIFE
THE NATURE OF TREES
NATURE'S TREASURE CHEST
THE SUSTAINABLE FOREST
FOREST HEALTH
WASTE NOT: WANT NOT

A seventh lesson, *FOREST FAMILIES*, is an enrichment activity provided for review and reinforcement of the concepts illustrated in the entire unit.

The California State Board of Education in its Science Frameworks reminds us that "To be effective, science education should be enjoyable." To this end, the material in this program was created to be not just informative but user-friendly, and entertaining.

Best wishes on implementing *FORESTS FOREVER.*

Sincerely,

Susana Taylor
Education Consultant, CFPC

UN PASEO POR EL BOSQUE

Vengan a explorar el bosque conmigo. Vamos a descubrir algo muy especial acerca del bosque, de los árboles que crecen allí, y de los animales que allí viven.

¡SÍGANME!

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2

LOS ÁRBOLES Y LOS CONOS

Los árboles que mantienen su verdor durante todas las estaciones del año se llaman coníferos. La palabra CONÍFERO viene de la palabra CONO. ¿Dónde tienen los coníferos las SEMILLAS? Sí, en los conos. No todos los conos son iguales. ¡Algunos de los ÁRBOLES más grandes tienen los conos más pequeños!

Traten de emparejar los conos con los árboles de los cuales vienen.

ABETO BLANCO

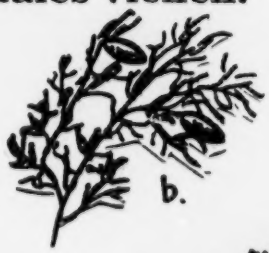
PINO AZÚCAR

PINO GIGANTESCO de CALIFORNIA

CEDRO INCIENSO

PINO PONDEROSO

ABETO DOUGLAS



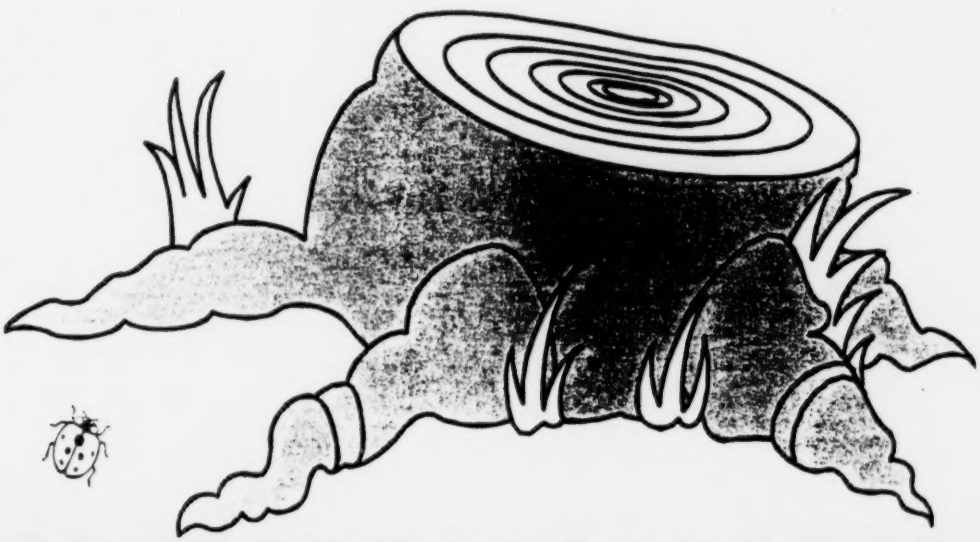
3. abeto Douglas b. cedro incienso c. abeto blanco d. pino ponderosa e. pino azúcar f. pino gigantesco

3

LA EDAD Y EL CRECIMIENTO DE LOS ÁRBOLES

¿Saben contar los **SONS** de un árbol? Si miramos al tocón y contamos los [illegible] que allí se ven, podemos saber la edad de un árbol. Cada año, un árbol crece dos anillos de madera. El anillo de **PRIMAVERA** crece muy rápido, en células [illegible] y más grandes. En el **VERANO** otro anillo crece, éste más despacio, en células más pequeñas y más **OSCURAS**. Empezando con el anillo más chico en el **CENTRO** del tocón, se cuentan los anillos **SONDSO** para determinar la **EDAD** del árbol. Los anillos **GRUESOS** indican años con mucha **AGUA**. Los anillos **DELGADOS** indican años de .

¿CUÁNTOS AÑOS TIENE ESTE ÁRBOL?



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4

¿SABEN LO SIGUIENTE?

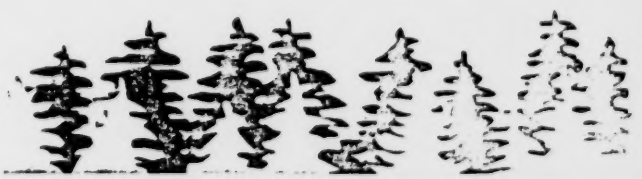
- Aunque el árbol llamado secoya crece muy grande, el tamaño de la semilla es solamente 1/16 de una pulgada. Se pueden llenar 123,000 de ellas en una bolsa de una libra.
- Cada año, cada uno de nosotros consumimos el equivalente de un árbol de 100 pies en productos hechos de arboles.
- Cada año, los guardabosques de California plantan 20 a 30 milliones de árboles nuevos.
- La madera el el único material de construcción en la tierra que se renueva, que es recirculable, y que es biodegradable.
- Los árboles se usan para hacer muchos productos- ¡más de 5,000!

É	M	Z	I	Í	S	C	A	R	T	O	N	E	S	A
R	E	L	Á	P	I	C	E	S	H	L	O	Í	R	Q
P	D	X	E	F	M	N	C	A	R	T	E	L	E	S
E	I	T	A	Ñ	Ó	J	Y	M	U	E	B	L	E	S
L	C	B	W	Y	A	B	C	J	A	P	R	E	B	O
Í	I	K	A	C	H	V	A	I	N	I	L	L	A	E
C	N	R	D	R	Ñ	D	S	K	U	C	E	S	U	K
U	A	É	F	E	C	Í	A	H	I	P	D	J	É	Y
L	S	L	I	B	R	O	S	H	A	F	Ñ	V	B	S
A	R	P	A	Q	G	R	C	P	K	Á	T	U	Í	N

¿Pueden encontrar algunos productos hechos de árboles en el buscapalabras?

¡Cuidado! Algunas de las palabras están escondidos en diagonal.

CARTONES	**CARTELES**	**MEDICINA**
PELÍCULA	**LIBROS**	**MUEBLES**
RAYÓN	**CASAS**	**LÁPICES**
BARCO	**VAINILLA**	**CHICLE**
ARPA	**LEÑA**	**PAPEL**



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LOS ANIMALES SALVAJES Y SUS HOGARES EN EL BOSQUE

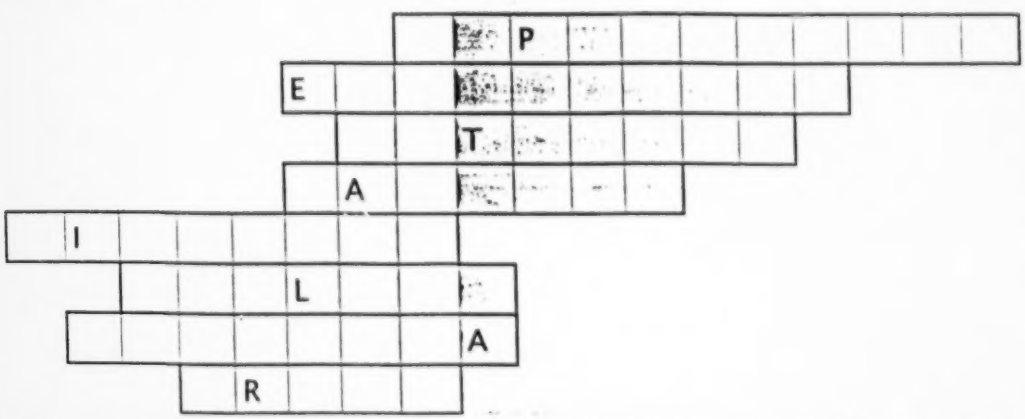
Pensemos por un momento en los muchos animales que hacen sus hogares en el bosque. Aunque todos los animales son muy diferentes los unos de los otros todos hacen lo que hacen los miembros de caulquier otra comunidad:

BUSCAN ALIMENTO SE PROTEGEN CUIDAN A SUS PEQUEÑOS

Contesten las preguntas para encontrar las letras en rojo del crucigrama. Ellas les dan la palabra para el estudio de las communidades de animales.

¿COMO SE LLAMA...?

1. UNA ESPECIE DE PLANTA O DE VIDA SALVAJE QUE ESTÁ EN PELIGRO DE DESAPARECER .
2. EL INSECTO QUE MASTICA ALREDEDOR DE LA CORTEZA DE UN ÁRBOL MATÁNDOLO.
3. EL CIENTÍFICO QUE ESTUDIA Y QUE PROTEJE LOS ÁRBOLES Y LAS OTRAS PLANTAS.
4. LOS ANIMALES QUE NO SON DOMESTICADOS.
5. LA ZONA AL LADO DE UN RÍO QUE MANTIENE LA COMIDA, LA SOMBRA, Y LOS NIDOS PARA MUCHOS ANIMALES.
6. EL CIENTÍFICO QUE ESTUDIA Y PROTEJE LA VIDA Y LAS NECESIDADES DE LOS ANIMALES.
7. EL ESTUDIO DE LAS ROCAS, DE LAS MONTAÑAS, Y DE LA TIERRA DEL MUNDO.
8. EL PEZ QUE NADA AGUA ARIBA PARA UBICAR LOS HUEVOS EN EL LUGAR EXACTO EN DONDE ÉL MISMO NACIÓ.



1. empeligrado 2. escarabajo 3. botánico
4. salvaje 5. ribereño 6. biólogo
7. geología 8. trucha

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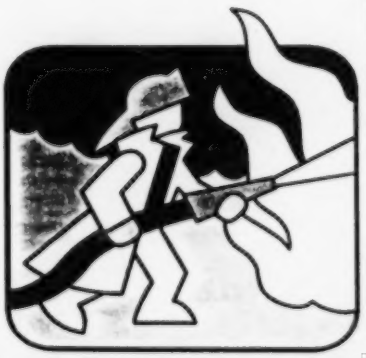
6

LOS ENEMIGOS NATURALES DEL BOSQUE

Los insectos, las enfermedades, y los fuegos son los ENEMIGOS naturales del bosque. Hoy día, muchas áreas de los bosques están DEBILITADAS debido al crecimiento de los árboles muy JUNTOS los unos de los otros. Cuando demasiados árboles crecen en una área, tienen que COMPETIR por el alimento, el agua, y el sol.

Los árboles se debilitan y pronto los INSECTOS y las ENFERMEDADES les atacan, matando muchos de ellos. Los árboles muertos y los que se están muriendo se SECAN. Cuando empieza un fuego, sube facilmente a las COPAS, ardiendo tan RÁPIDAMENTE y con tanta FUERZA que mata todo en su camino, hasta todo el organismo vivo dentro de la tierra, dejando estas áreas vulnerables a la EROSIÓN.



MENSAJE EN LAS BURBUJAS 7

USEN LA LEYENDA DE LOS NÚMEROS Y DE LAS LETRAS PARA DESCUBRIR COMO TRABAJAN JUNTOS LOS GUARDABOSQUES Y LOS CIENTÍFICOS PARA

- MANTENER LA SALUD DE LOS BOSQUES
- PROTEGER EL MEDIO AMBIENTE
- ASEGURAR QUE SIEMPRE TENGAMOS LOS PRODUCTOS DE MADERA

5,14, 20, 18, 5, 19, 1, 3, 1, 14, 4, 15,
12,15, 19
1, 18,2, 15, 12, 5, 19
13, 1, 14, 20, 9, 5, 14, 5
12. 15. 19
2. 15. 19. 17. 21. 5. 19

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8

Impreso sobre
papel recirculado

Gracias por tomar
UN PASEO POR EL BOSQUE
conmigo.

¡VUELVAN PRONTO!

Escrito e ilustrado
por
Susana Taylor
para la

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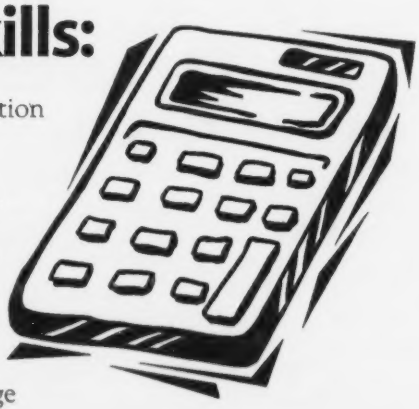
Lesson 1
The Web of Life

Objectives:

1. To understand the concept of ecosystems
2. To understand the interdependence of all members of a community

Skills:

1. Association
2. Math
3. Ecology
4. History
5. Logic
6. Art
7. Language



Vocabulary:

VOCABULARY

1. **Web of Life** - the network of relationships that interconnect all species of an ecological community
2. **Ecology** - the study of how plants and animals interact with their environment
3. **Environment** - the conditions or elements that surround an ecological community or its members
4. **Feedback** - the return of information about the result of a process or activity – It often results in change by the receiver of the feedback information.
5. **Balance** - a state of equilibrium or stability
6. **Energy** - a source of usable power, such as sunlight or food

Focus:

1. Establish the concept of "community" by having the students think of various types of human communities, for example:

- **our planet**
- **our country**
- **our state**
- **our city**
- **our neighborhood**
- **our school**
- **our classroom**
- **our families**

2. Establish the concept of "ecological communities" by identifying the Greek word "oikos" (house) and "logos" (the study of) as the basis of our word "ecology". Ask the class to guess what the "house" is in an ecological community (the environment). Ask the class to think of some ecological communities. Write them on the board. Below are some suggestions:

- **the forest**
- **the ocean**
- **an open field**
- **a lake**
- **a stream**
- **a park**
- **someone's yard**
- **a fish tank in someone's house**
- **a fallen log**
- **our bodies**

Ask the students to guess some of the members within the ecological communities that they have identified. Following are some suggestions:

the forest: trees, shrubs, wildlife, insects, fish, people, fungi (such as mushrooms), bacteria
the ocean: fish, mammals (such as whales), crustaceans (such as shrimp), mollusks (such as clams), seaweed, algae, bacteria
an open field: mice, birds, insects, worms, fungi, bacteria, plants
a lake: plants, fish, insects, birds, people
a stream: fish, insects, plants, wildlife, birds
a park: trees, flowers, birds, animals, insects, people
someone's yard: trees, plants, birds, animals, insects, people
a fish tank in someone's house: fish, plants, algae, insects, bacteria

CONTINUED ON REVERSE SIDE

a fallen log: fungi, moss, insects, animals, bacteria
our bodies: cells, bacteria, viruses

3. Establish the concepts of interdependence, feedback mechanisms, and natural balance by asking the students to guess what patterns all ecological communities share in common. Examples are given below:

They all need energy (food) to survive.

The success of the community depends on the success of the individuals. This is an example of interdependence.

The success of the individuals depends on the success of the community. This is also an example of interdependence.

The individuals within a community respond to changes in their environment by adapting. This is an example of feedback.

The community alters in response to changes by individuals within that community. This is an example of how ecological systems move toward natural balance.

4. Establish background for a writing activity on the Web of Life by asking if any of the students have ever played billiards or marbles. Ask them to point out what happens when one ball or marble hits another.

It affects the rest of the balls or the marbles.

Ask the students if any of them have ever driven bumper cars at an amusement park. Have them relate what happens when one car bumps another.

Other cars get rearranged.
They often hit adjacent cars, in turn.

Indicate to the students that this same dynamic process is what occurs in all ecological communities.

When something happens to one portion of an ecological community, everything else connected to it is affected, too.

5. Share with the students the following forest ecosystem example in light of the Web of Life, where change in one aspect of the ecological community elicits a change in another.

In a part of the forest, juicy seedlings have successfully competed with bitter plants for sun, water, and nutrients (food). Now there are plenty of juicy seedlings and many fewer bitter plants. Deer love juicy seedlings. They don't like to eat bitter plants. The deer discover this good feeding area and begin to browse freely. Over time, the deer population flourishes with the abundant food. The number of juicy seedlings goes down as they are eaten by larger numbers of deer. Since the bitter plants are not eaten by deer, and there are no longer as many juicy seedlings to compete with, bitter plants now flourish. With an increasing number of bitter plants and fewer tasty seedlings to feed on, the larger population of deer does not have enough to eat. Deer leave the area. As fewer deer remain to eat the juicy seedlings, these seedlings flourish once again, successfully competing with other plants in the area. Increasing numbers of juicy seedlings draw deer back into the area.

To help the students visualize the process, draw a double flow chart, as indicated on the sheet provided. This will illustrate feedback changes and prepare the class for the following activity.

6. Student writing activity:

Preface the activity by explaining that John Muir, California naturalist, once said:

> *"When we try to pick out anything by itself, we find it hitched to everything else in the universe."*

Ask the class to interpret what Muir was saying.

> *All members of an ecological community are connected by the Web of Life.*
> *What happens in one part of it affects all the other parts.*

Reinforce the concept of interdependence by reminding the class that the deer in the forest is an example of how in an ecological community many things change over the course of time, but that nature has many ways to balance the things that change.

Read the following two stories aloud. Ask the students to think about the scenes. Have them discuss then describe what is happening in these ecological communities by writing a paragraph or completing a flow chart, such as follows this lesson.

On a hillside in the forest, there is enough water to grow 100 healthy trees. Over many years, no fires, no insects, no diseases, and no harvesting of trees have thinned out the area. Now, there are 1000 trees competing for sunlight, nutrients (food), and water.

In what kind of health are many of those 1000 trees?

They are severely stressed. Trees that can't compete well will become weak and defenseless against fire, disease, and insects.

What eventually happens to most of the stressed trees?

They die.

What happens to the animals and insects that make use of all those trees?

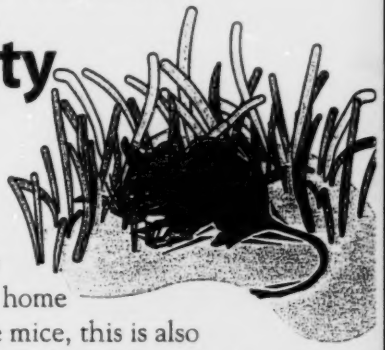
Insects in the area will flourish as they invade the stressed trees. They will grow to epidemic levels because they can easily spread among the overcrowded trees.

Animals often lose their homes and sometimes lose their lives in wildfires that occur most frequently in areas where there are lots of dead and dying trees.

What happens if some of those trees are thinned?

The remaining trees will be healthier.

Community Two



An area of the forest has lots of small shrubs and seedlings. It has very few large trees. It is a perfect home for mice. Since owls love mice, this is also a good hunting ground for owls. Over time, though, the seedlings and saplings in this area grow into older, taller trees which crowd together. They compete successfully for sun, water, and nutrients (food) and suppress the bushes, shrubs, and seedlings trying to grow in this area.

What happens to the mice as shrubs, bushes, and seedlings disappear?

They find new homes in other areas that provide more food and safety.

What happens to the owls?

They will have to hunt in other areas where they will be able to find mice.

What happens to the crowded trees?

They become stressed and are more likely to die of disease, insects, and fire.

What happens if the trees are thinned?

The trees that remain will be healthier.
Thinning will allow more sun, water, and nutrients to reach smaller plants.
The smaller shrubs and plants will bring back the mice.
The return of the mice will bring their predators back into the area.

Enrichment Activity:

Have the students work the **WHEEL OF FORTUNE** and **MEMORY MAGIC** puzzles. Memory magic will be more challenging for the younger student.

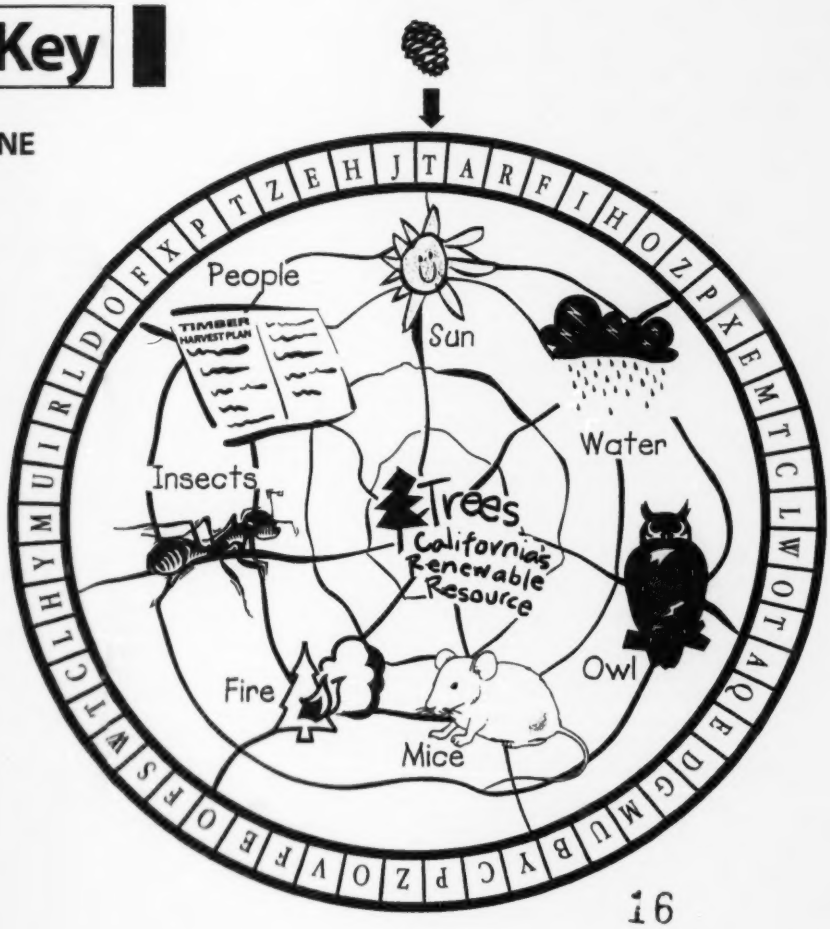
Answer Key

MEMORY MAGIC PUZZLE

						7 E	8 N	9 V	10 I	11 R	12 O	13 N	14 M	15 E	16 N	17 T		
20 H						26 N		28 I			31 R					36 R		
39 O	40 W	41 L				45 E		47 R			50 E					55 E		
58 U		60 O				64 R		66 U					71 M	72 I	73 C	74 E		
77 S		79 G				83 G		85 S			88 F				92 O			
96 E	97 C	98 O	99 L	100 O	101 G	102 Y			105 O	106 C	107 E	108 A	109 N		111 M	112 U	113 I	114 R
		117 S									126 E				130 M			
Memory Magic Puzzle											136 D				140 U			
											146 B	147 A	148 L	149 A	150 N	151 C	152 E	
											156 A				160 I			
											166 C				170 T			
									174 O	175 I	176 K	177 O	178 S		180 Y			

Answer Key

WHEEL OF FORTUNE



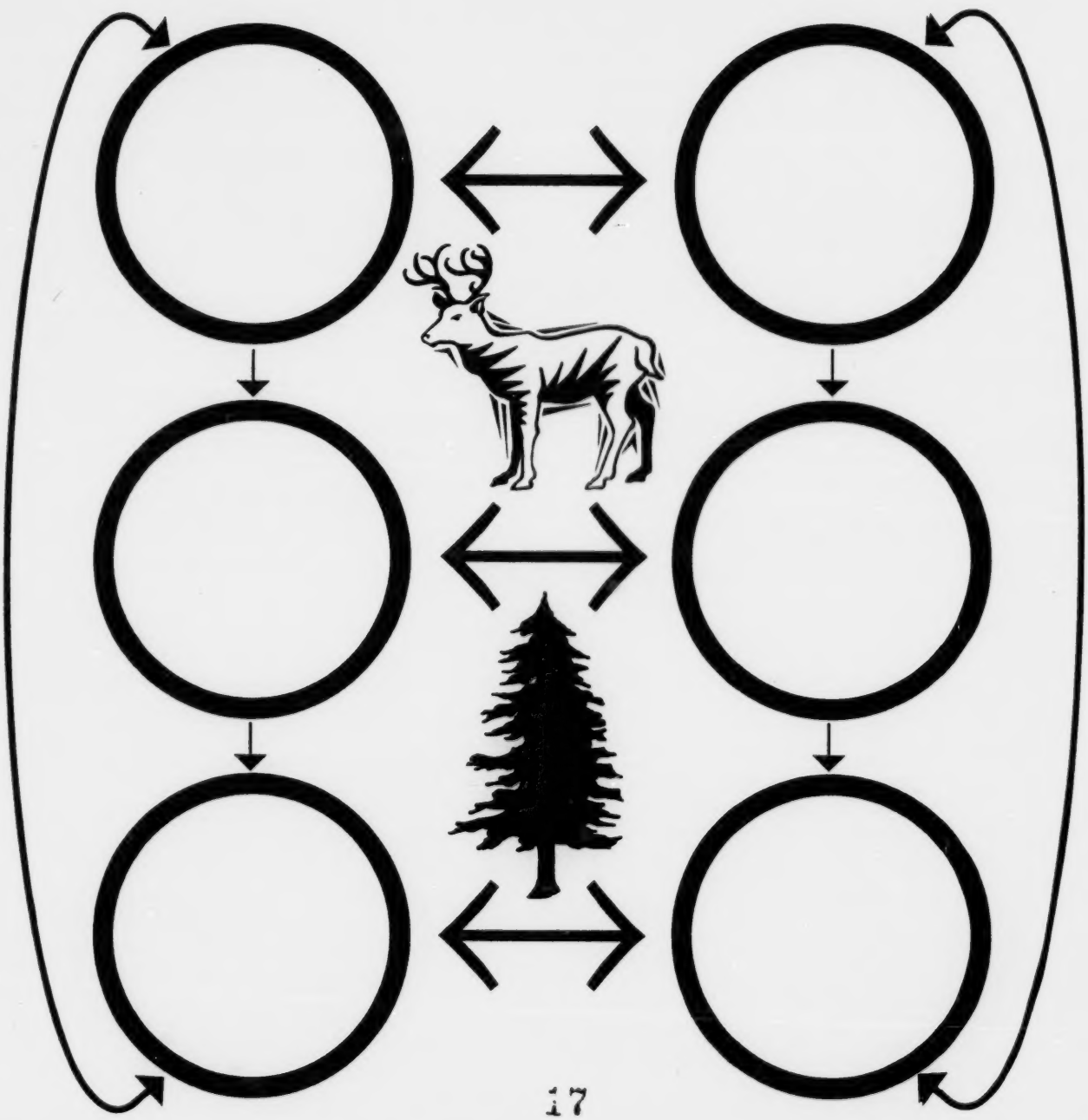
16

T H E W E B O F L I F E

Forest

FLOW CHART

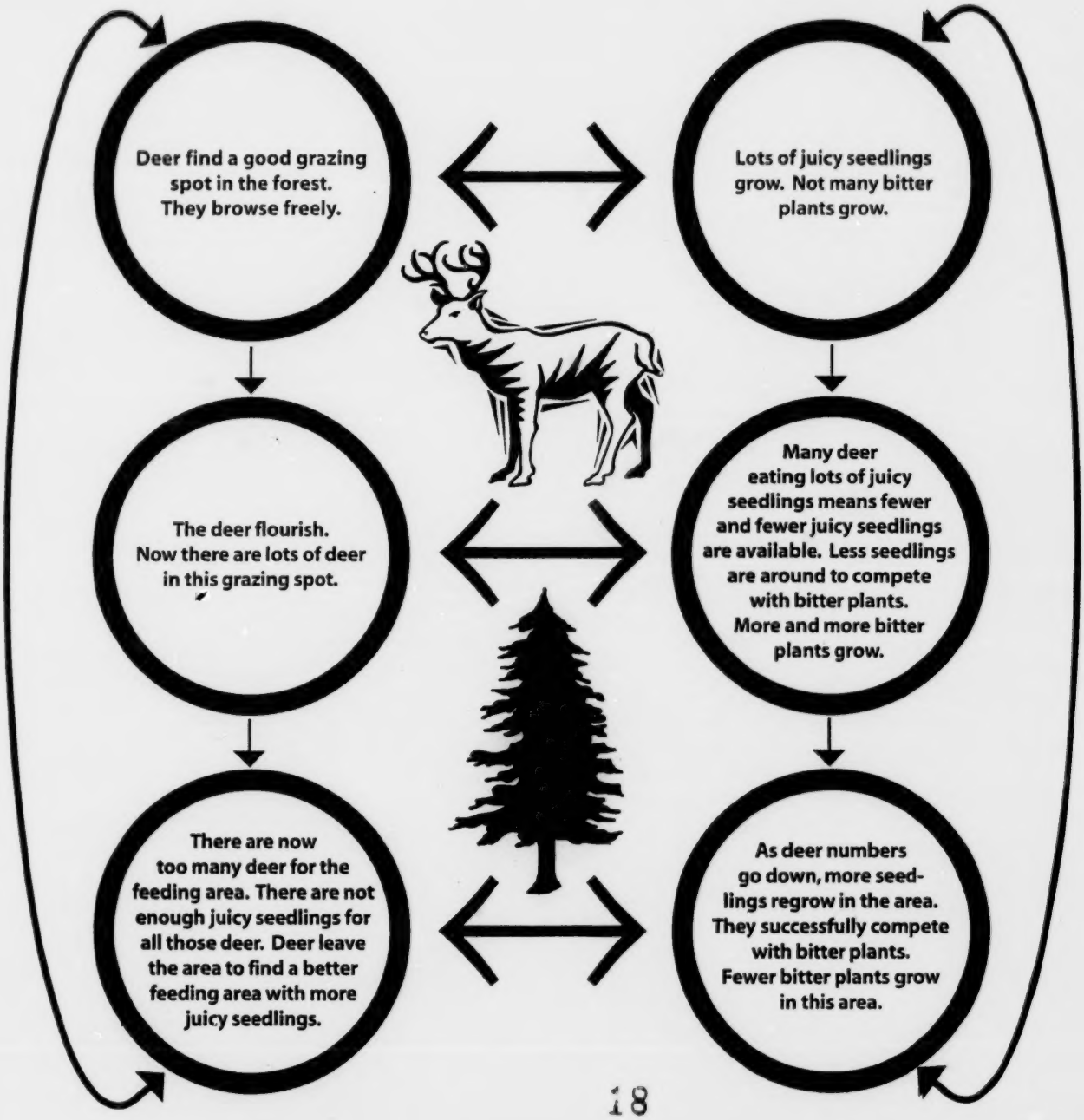
Name _____



Answer Key

Forest

FLOW CHART


Deer find a good grazing spot in the forest. They browse freely.
Lots of juicy seedlings grow. Not many bitter plants grow.
The deer flourish. Now there are lots of deer in this grazing spot.
Many deer eating lots of juicy seedlings means fewer and fewer juicy seedlings are available. Less seedlings are around to compete with bitter plants. More and more bitter plants grow.
There are now too many deer for the feeding area. There are not enough juicy seedlings for all those deer. Deer leave the area to find a better feeding area with more juicy seedlings.
As deer numbers go down, more seedlings regrow in the area. They successfully compete with bitter plants. Fewer bitter plants grow in this area.

18

Memory Magic

Down:

7. All members of an ecological community need _____ to survive.

9. A _____ is a member of the human body's ecological community. If we have too many of them, we usually get sick.

12. Iron _____ is a natural resource that helps make steel. It is not renewable.

17. A _____ is Earth's only renewable, recyclable, biodegradable resource.

20. The environment is our ecological _____. It is called "oikos" in Greek.

41. This Greek word means "the study of". Along with #174 across, it helps make our word "ecology".

73. The success of the _____ depends on the success of the individuals that are part of it.

88. Individuals change because of changes in their environment. We call this process _____.

Name _____

Can you perform MEMORY MAGIC? Work this crossword puzzle to see how much you remember about ecological communities.

Across:

7. The conditions or elements that surround an ecological community or its members is called the _____.

39. This bird hunts mice at night. Foresters work hard to protect it in California's forests.

71. The small rodents that are a food of owls are _____.

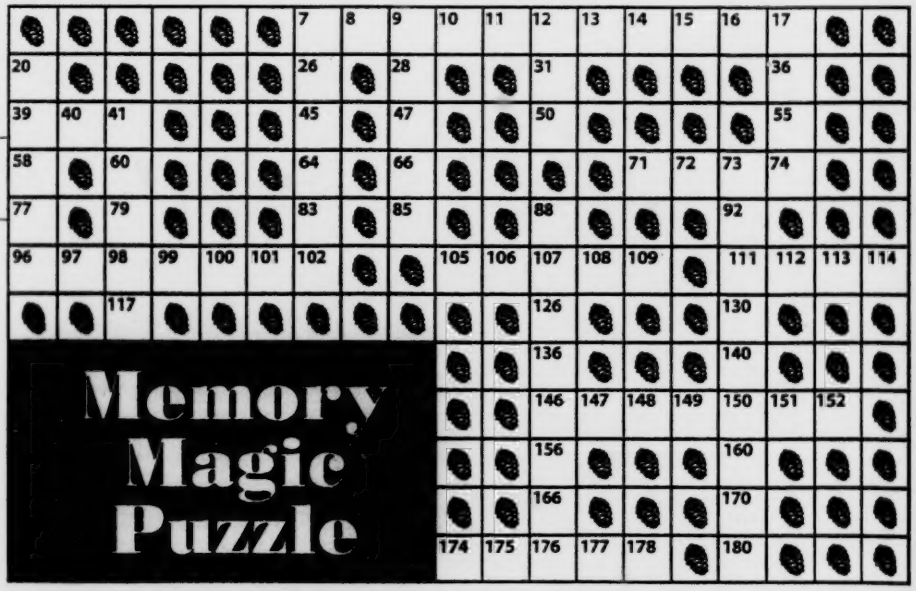
96. The study of how plants and animals interact with their environment is _____.

105. For a whale, the _____ is its ecological community.

111. A famous California naturalist was John _____.

146. An ecological community changes because of changes in its members. We call this process "natural _____".

174. The Greek word for "house" is _____. Together with #41 down, it helps from our word "ecology".



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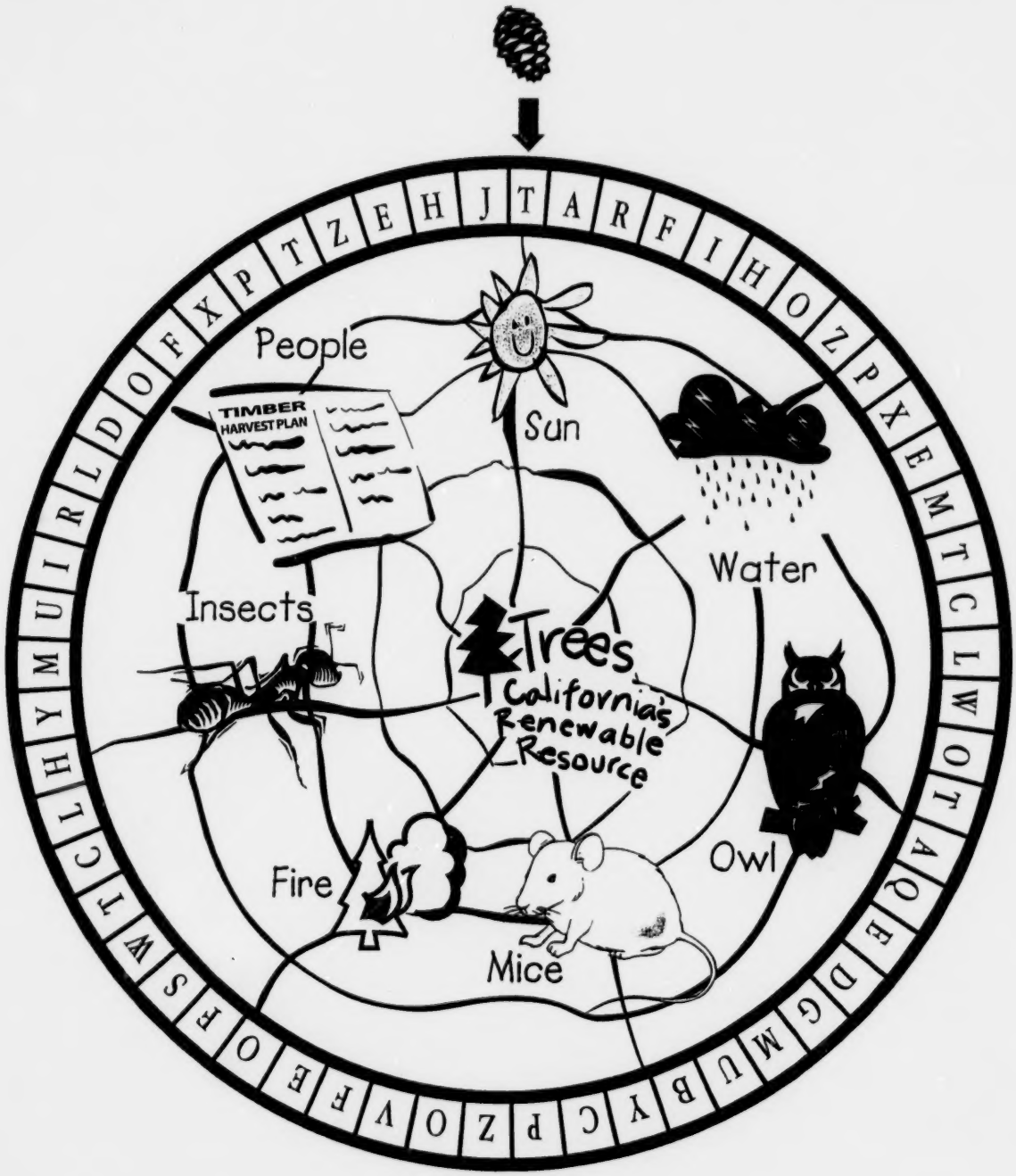
Wheel of Fortune

Name _____

Play the WHEEL OF FORTUNE below to decode the hidden message. The first letter has been given to you. Start after the pine cone and move to your right. You will need to find every 5th letter and place it on the grid at the bottom of the page. When you have made one full circle, you will know what connects all parts of an ecological community.



T _ _ _

Lesson 2

The Nature of Trees

Objectives:

1. To understand what parts make up a tree
2. To understand what function each part serves
3. To understand the relationship between the function and parts of a tree and those of humans

Skills:

1. Association
2. Botany
3. Human Physiology
4. Art

Focus:

1. Establish the value of trees by having the students list on the board the benefits that trees provide. Examples are illustrated below:

They provide shade and cool places.

They provide beautiful areas for relaxing, camping, and hiking.

They release oxygen into the air.

They clean the air by taking in carbon dioxide from the air.

Their roots keep dirt from washing away.

Fallen leaves and branches and dead trees decay and make the soil richer.

Leaves on both the branches and on the ground slow down the rainfall which helps the ground absorb moisture.

Trees provide homes and food for wildlife and humans.

They provide thousands of useful products which we use every day to make our lives better and more enjoyable.

CONTINUED ON REVERSE SIDE

Vocabulary:

VOCABULARY

1. **Bark** - the tough outside covering of a woody stem or root
2. **Cambium** - parallel rows of cells that form new layers of bark and wood
3. **Sapwood** - newly formed wood that lies just inside the cambium – It acts as a major conductor of water and minerals for the tree.
4. **Heartwood** - the hard, inactive wood at the center of the tree
5. **Roots** - the network below ground that holds the tree upright in bad weather – Root hairs, which push their way through the soil and absorb moisture, send water and nutrients up into the tree.
6. **Chlorophyll** - the green substance found in leaves and needles
7. **Photosynthesis** - the process of channeling energy from the sun by means of chlorophyll and converting the carbon dioxide in the air to produce nutrients for the tree
8. **Oxygen** - an element found freely in nature that is needed for humans and animals to be able to breathe and is necessary for nearly all combustion to occur
9. **Carbon Dioxide** - a colorless, odorless, incombustible gas that is formed during respiration, combustion, and organic decomposition

2. Establish the concept of photosynthesis by identifying the Greek words "photo" (light) and "synthesis" (to put together) as the basis of our word for this process. Ask the students to guess what this word might mean.

3. Establish that trees and people are perfect partners by discussing the process of photosynthesis. Have each student draw his own circular flow chart as you illustrate a large one, such as the one provided at the end of this lesson, on the board. There are information bubbles for each phase. Have the class draw arrows from one phase to the next, with the last arrow returning to the first phase.

4. Establish how people and trees share things in common by discussing how different parts of trees serve different functions, as different parts of our bodies serve different functions for us.

If the needles and leaves take in and get rid of carbon dioxide and oxygen, what part of the human body are they like?

the lungs

Our human skeletons support our bodies. What supports a tree?

its trunk (its heartwood); its roots

What system handles nutrients (food) and water for a tree?

The needles and leaves produce nutrients in photosynthesis.

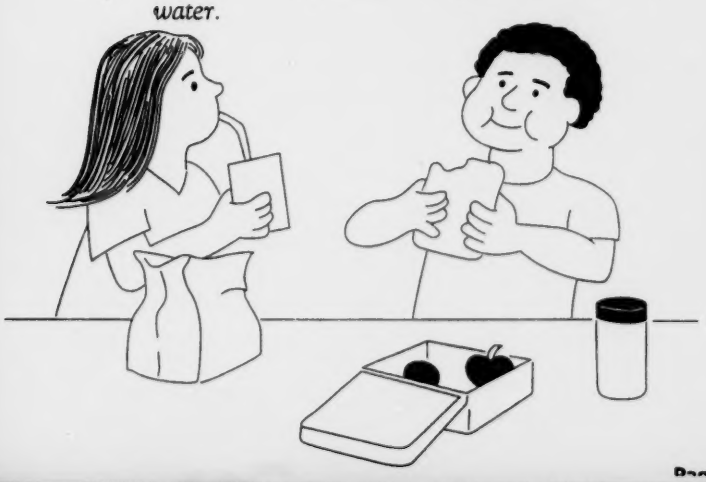
The sapwood transports nutrients (food) and water.

The roots store water and send it up the tree for growth.

What system handles food and water supplies for humans?

Our digestive system processes nutrients and water.

Our circulatory system transports nutrients and water.



Enrichment Activity:

1. Make separate copies of both sides of the Wonderful Workings of Wood activity sheet.

2. Have the students glue the picture showing the cross section of a tree to construction paper or poster board for support.

3. Let the project dry if too wet from enthusiastic gluing.

4. Have the students use glue stick to apply glue to the marked sections of the tree, one section at a time, avoiding the indicated numbers. Lightly sprinkle with the correct coating.

NOTE:

To reduce waste during the sprinkling phase of the project, have the students GENTLY shake off the excess coating onto designated paper plates, one for each type of coating. Other students can then make use of these materials.

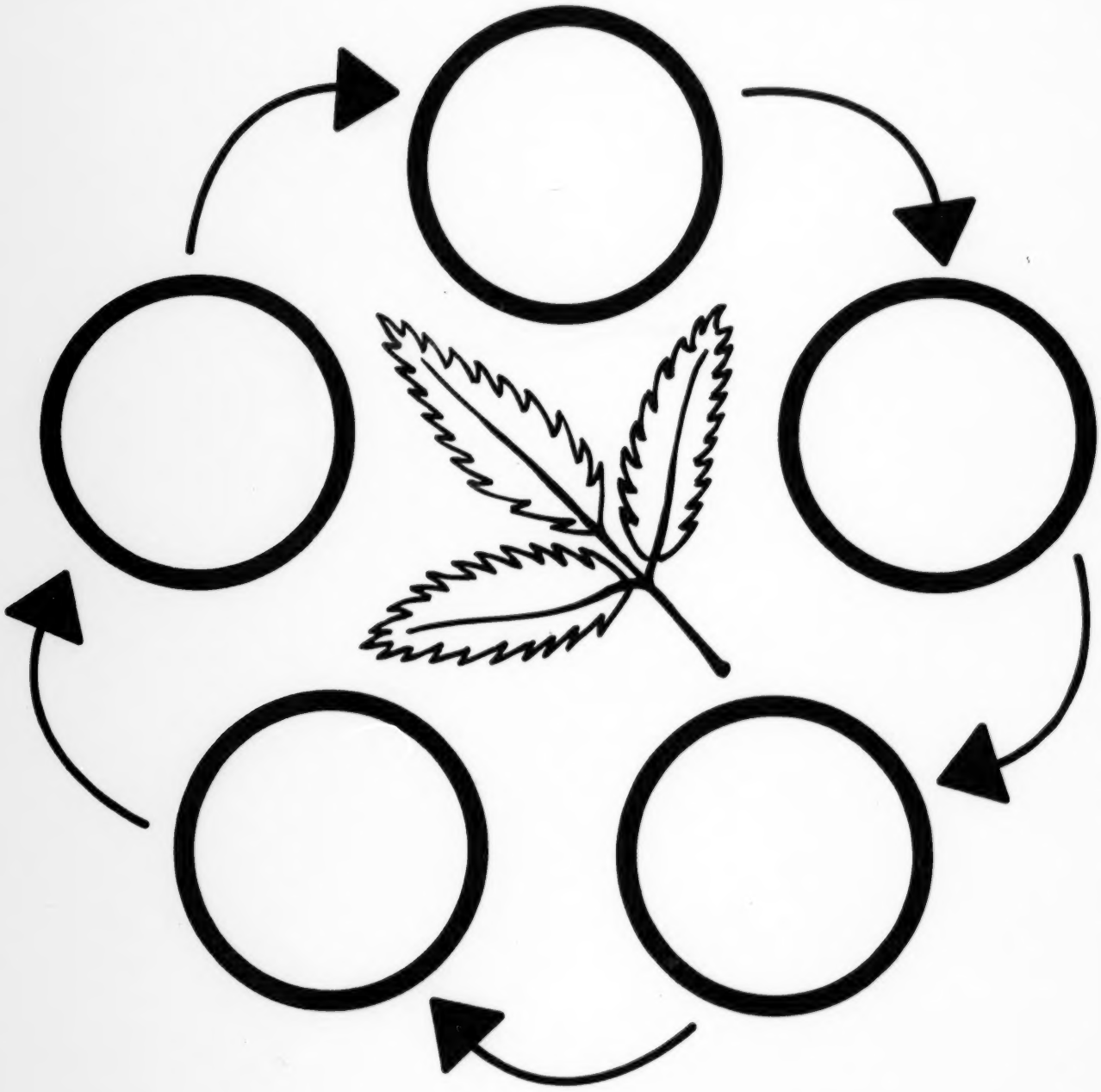
SUGGESTIONS FOR COATINGS:

- *chocolate baking sprinkles for inner bark*
- *poppy seeds for outside bark*
- *sesame seeds or powdered milk for cambium layer*
- *yellow baking sprinkles or powdered mustard for sapwood layer*
- *paprika, cinnamon, or chili powder for the heartwood*
- *green baking sprinkles or green sugar crystals for the needles*

Name _____

Photosynthesis

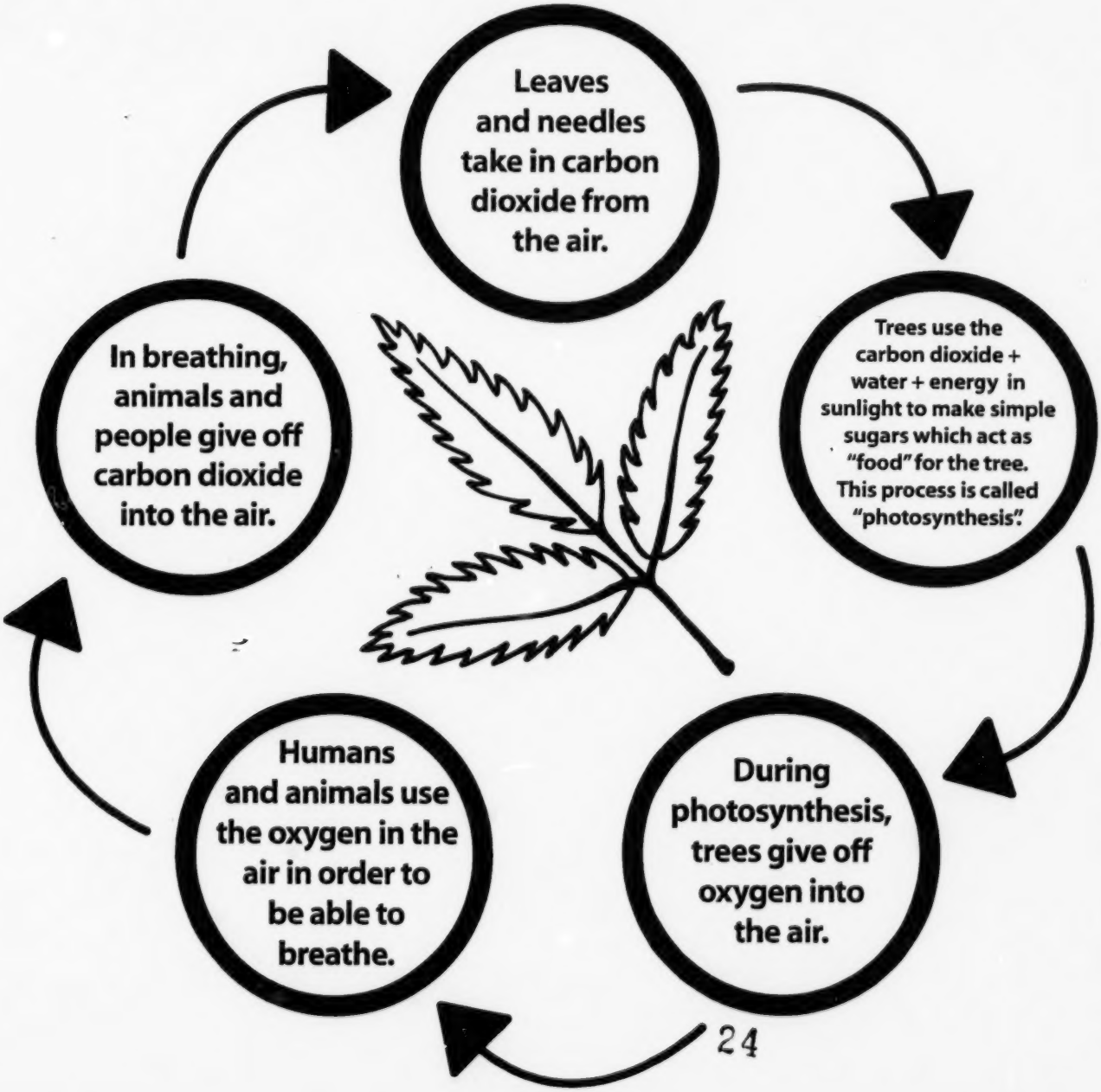
FLOW CHART



Answer Key

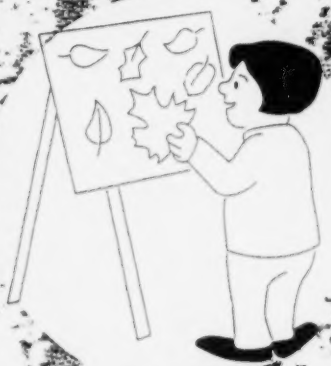
Photosynthesis

FLOW CHART


Leaves and needles take in carbon dioxide from the air.
Trees use the carbon dioxide + water + energy in sunlight to make simple sugars which act as "food" for the tree. This process is called "photosynthesis".
During photosynthesis, trees give off oxygen into the air.
Humans and animals use the oxygen in the air in order to be able to breathe.
In breathing, animals and people give off carbon dioxide into the air.

24

The Wonderful Workings of Wood



Most people think that wood is just one thing. Actually, wood is made up of different parts, each with its own job. Use this numbered guide to discover what the parts of a tree are called and what job each part does. The guide will also act as your legend for the texture picture that you will find on the next page.

1. **OUTER BARK** is like your skin. It protects the tree from outside damage.

2. **INNER BARK** brings the food that is produced in the leaves to the rest of the tree, where it is used for growing or is stored.

3. **CAMBIUM** is made from clusters of cells that produce new layers of bark each year. These layers are called rings. Starting with the heartwood, we count the dark rings to tell the age of the tree.

4. **SAPWOOD** is the highway that carries minerals and water to all parts of the tree. The chemicals in the sap are what determine the color that leaves turn in the fall.

5. **HEARTWOOD** acts as our spine does. It gives strength to a tree and helps it to stand straight.

When we look at a slice of wood, it not only helps us tell the age of a tree, it also tells us about its history. We can see when and where insects invaded and made holes and tunnels in it. We can see when and where fire scarred it. We can even tell which years have been wet years and which ones were drought years. Thick rings show plenty of moisture; narrow rings show little moisture.

What do foresters do if they want to know the age of a tree that has not been harvested? They often use a tool called an increment borer. It looks a little bit like a narrow flute. Foresters use it to pull a small plug of wood from the tree, somewhat the way we use a corkscrew to remove a cork from a bottle. They can then read the rings from the tree plug just the way they might with a wafer of wood from a limb or from a tree stump. Do they put the plug back into the tree? No. The tree will send its sap to plug the hole and protect the tree from possible invasion by insects or disease. If the plug is put back in, the tree will be fooled into thinking that there is no hole, and it will not send sap to seal that opening. The plug will not make a good seal. It will leave the tree open to insects and disease.

The next time you see a tree stump, read the rings. What history does it have to tell?

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Name _____

Lesson 3

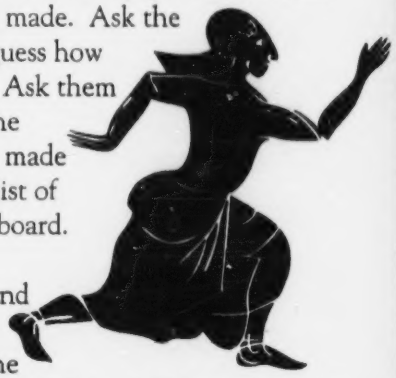
Nature's Treasure Chest

Objectives:

1. To understand and appreciate the variety of forest products that we all use in our everyday lives
2. To appreciate wood as earth's only renewable, recyclable, and biodegradable resource
3. To learn how paper is made

Focus:

1. Establish the concept of the word "paper" by identifying the Latin word "papyrus" named after the Egyptian reed from which paper was first made. Ask the students if they can guess how paper is made today. Ask them to think of some of the things they know are made from wood. Make a list of their answers on the board.



2. Establish the value and variety of forest products by having the students read the story "Nature's Treasure Chest". After they have finished reading it, have the students circle or highlight all the wood products that they can find in the story. Review with the class the answers and explanations of the many surprising products derived from wood.

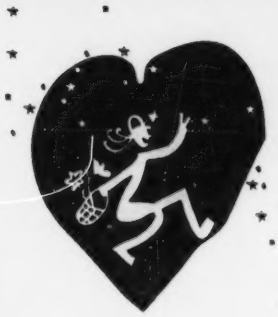
✓Skills:

1. Association
2. Consumer Awareness
3. Science
4. Reading
5. Language
6. Math
7. Art

Vocabulary:

1. **Renewable** - having the capability of replenishing itself
2. **Recyclable** - being able to be utilized again, often by being restructured into something else
3. **Biodegradable** - being able to be broken down or decomposed by natural means
4. **Cells** - the basic building blocks of living things
5. **Cellulose** - the material that makes up plant cell walls
6. **Fiber** - thin threads that bind together to form animal and plant matter
7. **Lignin** - the sticky substance that binds plant cells together
8. **Pulp** - the mash that forms when wood chips are cooked

VOCABULARY



Enrichment Activity:

1. Make recycled paper as a class project. Instructions are included below. The students may take home the instruction sheet and work the project at home with their families.

2. Make a greeting card out of recycled paper. Students can draw designs on their finished paper. Use a glue pen to write a message or design a border and then sprinkle with glitter. Punch a hole in the corner and run curly ribbon through it to form a gift tag, if preferred.

Making Recycled Paper

INGREDIENTS

Large square pan, about 3 inches deep

3 cups of water

A whole section of newspaper

A rolling pin, or a liter glass beverage bottle, or a plastic pipe, tube, or any cylinder to roll with

STEP 1

Tear 1-2 pages of newspaper into small pieces of 1 inch or less.

STEP 2

Put the paper chips into a large bowl and add all the water to it. Keep adding paper, tearing it and squeezing it, until the mixture looks like thick oatmeal.

STEP 3

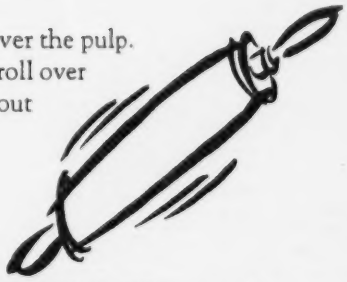
With the pan turned UPSIDE DOWN, place about 1 cup of the blended pulp over the bottom of the pan. Spread it with your fingers evenly across the entire area.

STEP 4

Lay several sheets of newspaper over the pulp, then carefully turn the pan over. Remove the pan. Your pulp "square" is now sitting on the newspaper.

STEP 5

Close the newspaper over the pulp. Using the rolling pin, roll over the newspaper to blot out the extra water.



STEP 6

Uncover and let the new "paper" dry COMPLETELY. When it is thoroughly dry, peel your new "recycled paper" away from the newspaper. It can now be cut to any size and used to make a variety of things.

Nature's Treasure Chest

Name _____

Read the story below then circle the items in it that you think are made from a tree. When you finish, check your answers with the key that starts on the next page.

"Hurry, Randy, or you'll be late for school," Mrs. Carter called out from the kitchen.

Randy's hand slid over the smooth handrail as he raced down the stairs. He skipped the last three steps and landed with a thud.

"Coming, Mom," he mumbled through the thick sweatshirt that he put on over his new rayon shirt. He walked down the corridor, his shoelaces tapping on the shiny wood floor.

"What's for breakfast? I'm starved," he said. Randy slid across the bench to his place next to his father's chair at the head of the table. The smell of vanilla coming from the stack of steaming pancakes made his mouth water. The aroma of the spicy sausage on his plate made his stomach grumble. "Pass me the maple syrup, please." Randy reached for the carton of icy cold milk.

"And good morning to you, too," Mr. Carter said, folding the newspaper and setting it down beside him. "Did you finish that report you were working on last night? I've got two tickets to the basketball game this evening and lots of film in the camera. I'd hate to go by myself."

"No problem, Dad. It's done." Randy drank the last drop of milk then wiped his mouth with his napkin and slid off the bench. "See you tonight."

Mrs. Carter opened the cabinet door and pulled out a box of apple juice and a box of chocolate chip cookies. She added them to the cellophane wrapped sandwich and orange already in the brown lunch sack.

"Brush your teeth before you leave, Randy," she said.

"No time. Besides, I can't find my toothbrush, and I'm out of toothpaste," Randy answered. He picked up his books and pencils, his football helmet, and his lunch sack then headed for the front door. "Bye, Mom."

As Randy closed the door, he saw the school bus round the corner, its shiny, black tires gleaming in the morning sun. He hopped over his mom's planter boxes and ran across the lawn. Down the street he raced—past four houses, three picket fences, two signs, and a telephone pole. He reached the corner just as the bus came to a halt in front of the bus-stop bench. All of his friends were already lined up to get on.

Beth Parker, the prettiest girl in his class, was the last in line. Beth wore lavender glasses, pretty pink polish on her nails, and always smelled like hairspray, strawberry lipgloss, and peppermint candy. She turned around and smiled at Randy.

"You were lucky today," Beth said.

"That wasn't luck. That was perfect timing."

"Well, someday you're not going to make it to the bus in time," she said.

"Never," he answered, as he stuck a piece of gum in his mouth. Randy climbed the steps, then walked along the black rubber matting to the wide seat at the back of the bus.

The doors closed with a hiss as the bus rumbled down Hudson Street.

~The End~

BEST COPY AVAILABLE

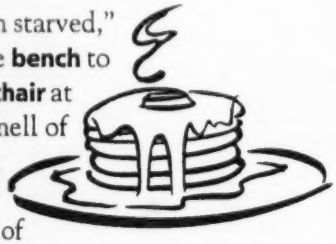
Answer Key

NATURE'S TREASURE CHEST

"Hurry, Randy, or you'll be late for school," Mrs. Carter called out from the kitchen.

Randy's hand slid over the smooth **handrail** as he raced down the **stairs**. He skipped the last three **steps** and landed with a thud.

"Coming, Mom," he mumbled through the thick sweatshirt that he put on over his new **rayon** shirt. He walked down the corridor, his shoelaces tapping on the shiny wood **floor**.



"What's for breakfast? I'm starved," he said. Randy slid across the **bench** to his place next to his father's **chair** at the head of the **table**. The smell of **vanilla** coming from the stack of steaming **pancakes** made his mouth water. The aroma of the spicy **sausage** on his plate made his stomach grumble. "Pass me the **maple syrup**, please." Randy reached for the **carton** of icy cold milk.

"And good morning to you, too," Mr. Carter said, folding the **newspaper** and setting it down beside him. "Did you finish that **report** you were working on last night? I've got two **tickets** to the basketball game this evening and lots of **film** in the camera. I'd hate to go by myself."

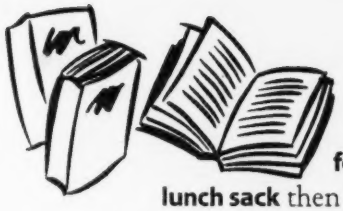
"No problem, Dad. It's done." Randy drank the last drop of milk then wiped his mouth with his **napkin** and slid off the **bench**. "See you tonight."

Mrs. Carter opened the **cabinet door** and pulled out a **box** of **apple** juice and a **box** of chocolate chip **cookies**.

She added them to the **cellophane** wrapped sandwich and **orange** already in the brown **lunch sack**.

"Brush your teeth before you leave, Randy," she said.

"No time. Besides, I can't find my **toothbrush**, and I'm out of **toothpaste**," Randy answered. He picked up

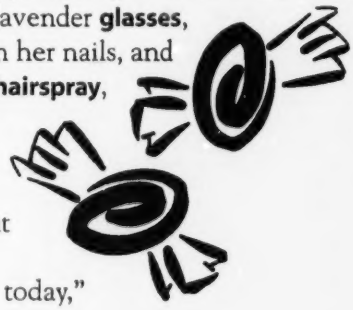


his **books** and **pencils**, his **football helmet**, and his **lunch sack** then headed for the front **door**.

"Bye, Mom."

As Randy closed the **door**, he saw the school bus round the corner, its shiny, black **tires** gleaming in the morning sun. He hopped over his mom's **planter boxes** and ran across the lawn. Down the street he raced—past four **houses**, three **picket fences**, two **signs**, and a **telephone pole**. He reached the corner just as the bus came to a halt in front of the **bus-stop bench**. All of his friends were already lined up to get on.

Beth Parker, the prettiest girl in his class, was the last in line. Beth wore lavender **glasses**, pretty pink **polish** on her nails, and always smelled like **hairspray**, strawberry **lipgloss**, and **peppermint candy**. She turned around and smiled at Randy.



"You were lucky today," Beth said.

"That wasn't luck. That was perfect timing."

"Well, someday you're not going to make it to the bus in time," she said.

"Never," he answered, as he stuck a piece of **gum** in his mouth. Randy climbed the steps, then walked along the black **rubber matting** to the wide seat at the back of the bus.

The doors closed with a hiss as the bus rumbled down Hudson Street.

~The End~

BEST COPY AVAILABLE

Answer Key

NATURE'S TREASURE CHEST

Many people know that furniture, lumber for building houses, paper, and books are wood products. But did you know that over 5,000 different products come from trees? Some of them are pretty surprising. Through the magic of modern science, man has learned how to take the fiber from trees and create wonderful items that make our everyday lives better and more enjoyable. How do they do it?

A tree is like any other plant, only bigger. It is built of plant **CELLS** made of **CELLULOSE** that are held together by **LIGNIN**. The lignin acts as a type of glue holding all the cells together in bundles of fibers. If the wood is cut into chips and then cooked into **PULP**, the lignin dissolves. The cellulose can now be separated out and cooked again. Soon it is a stew of fibers and a liquid called **CELLULOSE ACETATE**.

Some wood products come directly from the tree. Some come from the cellulose pulp, the lignin, or the cellulose acetate. Many medicines, clothing, foods, cosmetics, paints, even some "plastics" are wood products. So the next time you use a bowling ball, put on your new rayon dress, rinse with mouthwash, eat a cookie, or play your drums—**THANK A TREE**—and thank California's foresters who keep our forests healthy and growing for all of us to enjoy.

Below are the items made from trees that were included in the story you read about Randy. How many of them did you find? If you got them all, you are

TREE-RRRR-FIC!

HANDRAIL, STAIRS, STEPS, FLOOR, DOOR, CUPBOARDS: Many homes have stair parts and floors made of oak, pine, or fir because these woods are sturdy and attractive. Do you have a staircase in your home? What kind of wood was used to make it? Sometimes maple is used for a highly polished wood floor. Doors are most often made of pine and fir, but sometimes they are made of oak or even redwood. Many kitchen cabinets are made of pine or oak. Some are made of cherry. Make a tour of your house. Do you have a wood floor, or does carpet cover it? What kind of front door do you have? Are your cupboards wood? Are they painted or are they natural colored?

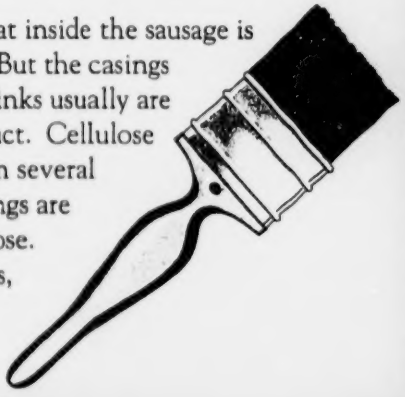
RAYON: This fabric is very popular because it is light and comfortable and can be made into clothes used for fancy occasions or clothes made for fun. Rayon is produced from cellulose acetate. Check the closets and drawers in your house. How many things do you and your family use that are made from rayon?

BENCH, CHAIR, TABLE: Furniture comes in all shapes and sizes and is made from many different materials. Today, it is often made from pine, oak, and teak. Makers of fine wood furniture like using walnut, cherry, and mahogany. These woods do not splinter easily and look beautiful when they are sanded smooth and polished.

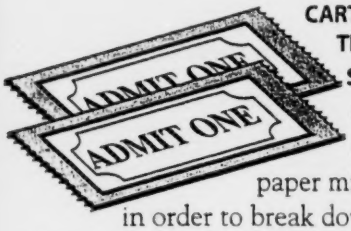
VANILLA: Artificial vanilla is used in many baked goods that are found in the stores or are baked at home and is sometimes called vanillin. It is made from lignin. Lignin is used in some baby foods, pet foods, and deodorants to help hold the ingredients of these products together. Some medicines that help with high blood pressure and Parkinson's disease also come from lignin.

PANCAKES, COOKIES: Baked goods sometimes contain an ingredient called torula yeast. It comes from the wood sugars that are produced when pulp is made. Torula contains lots of protein. It has five times more iron in it than Popeye's spinach or good old California raisins. Torula yeast is also found in baby foods, cereals, imitation bacon, beverages, and many diet foods. Torula even seems to make bees and lobsters grow faster! What products in your kitchen have torula yeast or artificial vanilla in them?

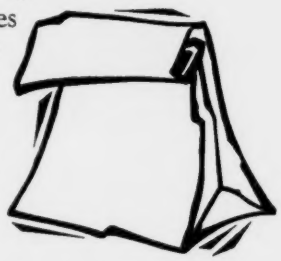
SAUSAGES: No, the meat inside the sausage is not made from wood! But the casings that hold the meat in links usually are cellulose, a wood product. Cellulose is tasteless and comes in several varieties. Sausage casings are made from ethyl cellulose. So are hard hats, combs, brushes, luggage, and fishing floats.



MAPLE SYRUP: The ingredient that soaks into our hot pancakes and shines on top of our puddings is the forest product we call maple syrup. It is the sap that flows through the cells of the sugar maple tree. This wonderful treat is tapped from the tree in early spring when the sap begins to move through the tree again after a winter rest.



CARTON, NEWSPAPER, REPORT, TICKETS, NAPKIN, BOX, BOOKS, SACK: Ordinary paper is most often made from softwoods such as pine and fir. In paper mills, wood chips are cooked in order to break down and soften the fibers. Next, they are washed clean and put into a beater. Beating makes the fibers fluffy so that they will hold together better. The mixture is now called wood pulp. At this point, dyes are often added to the pulp to give it color. Then it is spread out very thinly on a wide, wire screen. The pulp moves along a conveyor belt where most of the water drains out through the mesh. The rest is squeezed out by a series of rollers. As the fibers dry, they bind themselves together and become paper. Many paper products that are manufactured today are made from recycled paper. What does recycled mean? The next time you buy greeting cards, toilet paper, paper towels, facial tissues, cereal and other grocery boxes, check to see if they are made from recycled paper. What is printed on your paper grocery store bags? Does it show how much of the paper used to produce these bags is recycled? Making recycled paper is easy and fun. A recipe for making it is included in this lesson.

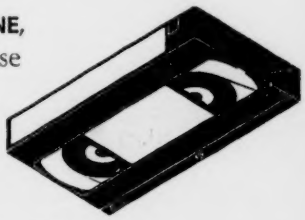


APPLE JUICE, ORANGES: Most of the fruit we eat comes from a tree. We squeeze fruits into juice, cook them to make jams, jellies, and syrups, use them to help flavor other foods such as pies, and eat them fresh. What is your favorite way to enjoy fruit? What job does the fruit do for the tree? Here is a hint: What do we find hidden inside the fruit?

FOOTBALL HELMETS: Though they don't look like it, plastics are sometimes made by using wood. Wood flour is mixed together with other ingredients to form the plastic parts to many household appliances, like coffee makers, and sports equipment, like hockey helmets and baseball hard hats. Scientists believe that using wood fiber strengthens the plastic.

TIRES, RUBBER MATS: Rubber trees originally came from South America, but now large rubber tree plantations are also found in the tropical areas of Africa and Asia. Workers make a cut into the bark of the tree and set a cup beneath it to catch the sap called latex. The latex is then made into rubber. What other items can you think of that are made from latex rubber? Can you think of another wood product that comes from tapping into the bark of the tree to catch its sap?

PHOTOGRAPHIC FILM, CELLOPHANE, TOOTHBRUSH, EYEGLASSES: These everyday items are made from cellulose. VCR tapes, sponges, and cellophane tape are also made from cellulose. Look at the knives and tools in your kitchen and workshop. Many of the handles are made from regular wood or from the wood product, cellulose.



NAIL POLISH, HAIRSPRAY, LIPSTICK, PEPPERMINT CANDY, GUM: The cosmetic and food industries make use of wood oils to give their products scent and flavor. Sandlewood is used in many perfumes and incense sticks. Eucalyptus is the smell we recognize in ointments, cough drops and syrups. Chewing gum uses both of these oils for fragrance along with chicle, an ingredient that is found in the forests of Central America. The drops of chicle that ooze out of the tree are what we find so much fun to chew!

PLANTER BOXES, HOUSES, FENCES, SIGNS, TELEPHONE POLES, BUS STOP BENCHES: The strong smelling oils in the wood are what makes redwood and cedar ideal for outdoor furniture, decks, planter boxes, and fences. These oils help protect redwood and cedar products from insects and also from damage by the rain, sun, and wet soil. Carpenters love to build with redwood and cedar because they have no knots in them. Their grain is straight and smooth. Some houses are made entirely out of wood. In other houses, the framework, the outside covering, and the shingles on the roof are made of wood. Douglas fir, white fir, and ponderosa pine are most often used to build houses. Douglas fir is also used to make telephone poles and bus-stop benches, while ponderosa pine is used to make most wood signs. Does your house have wood siding? Do you have shutters on your windows or decks around your house? Is there a gazebo or a birdhouse in your backyard? Does one of your neighbors have a wooden mailbox or a "FOR SALE" sign in his front yard? Take a walk in your neighborhood. How many things do you see made from a tree?

Lesson 4
The Sustainable Forest

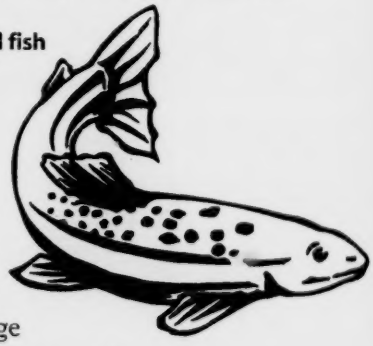
Objectives:

1. To understand that California has the most comprehensive timber harvest regulations in the nation
2. To understand that California foresters must prepare a timber harvest plan and have it approved by the Department of Forestry before harvesting may take place on private forest land in California
3. To understand that many different kinds of forest workers cooperate to help a registered professional forester in preparing a timber harvest plan, such as wildlife and fisheries biologists, botanists, geologists, and hydrologists
4. To understand that sustainable forestry ensures balance between increasing consumer demands for wood products and safeguarding environmental needs

Focus:

1. Establish the comprehensive nature of laws that protect California's forests and wildlife by asking the students to guess what some of these laws might concern. Put their suggestions on the board. Examples are given below:

•protecting wildlife and fish
•keeping water clean
•keeping the air clean
•protecting other plants in the forest



2. Read together the material in the "Did You Know?" activity sheet on the next page to validate correct answers and to illustrate some of the particular rules that protect forest health and provide protection for wildlife.

✓Skills:

1. Ecology
2. Environmental Sciences
3. Natural History
4. Government
5. Art
6. Association

Vocabulary:

VOCABULARY

1. **Relic** - an object with historic value that has survived from the past
2. **Hydroelectric plant** - a place where electricity is produced by the energy of rapidly moving water
3. **Spawning** - the producing or depositing of eggs by fish
4. **Erosion** - the wearing away of the soil, usually by wind or water
5. **Riparian zone** - the area along a river or a stream

Enrichment Activity:

1. Have the students make a forest panorama display:

✓Color the picture.

✓Cut the information windows along the dotted lines.

✓**EMPHASIZE NOT TO CUT THE TOPS OF THE WINDOWS!**

✓Have the students glue a perimeter along the outside back of the panorama ONLY.

✓Glue the panorama to the information sheet along the outside perimeter.

✓The two pages need to be positioned so that the written information lines up with the windows.

2. Make an optional set of props so that the panorama can stand:

✓Give students two 3x5 index cards.

✓Have them fold each card in half.

✓Have them glue one half of each card, with the fold up, to the back of the finished panorama. The card will act as a prop.

Information for Panorama Windows

WINDOW # 1
Areas may not be harvested near archeological sites, such as those areas containing Native American relics.

WINDOW #2
Some salmon are in trouble because they have been overfished.

WINDOW #3
Dams and hydroelectric plants block salmon waterways so the fish can't reach their spawning grounds.

WINDOW #4
Old methods of logging once blocked streams. Now foresters and others work to help salmon increase their numbers.

WINDOW #5
Forest roads must be built carefully in order to prevent erosion.

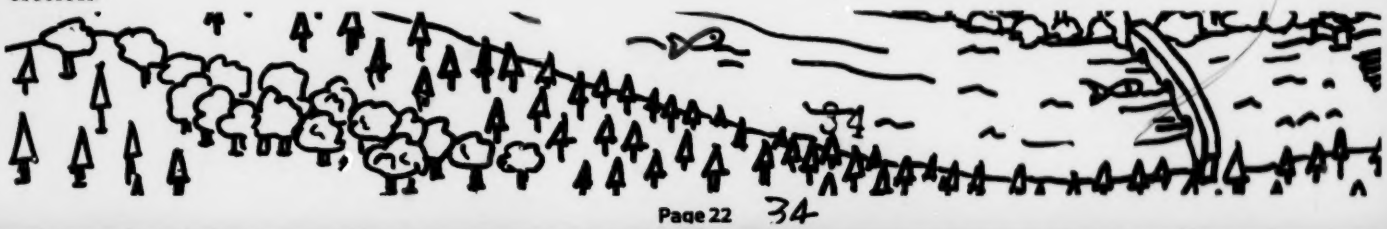
WINDOW #6
Trees may not be harvested along either side of a waterway. These areas are called riparian zones.

WINDOW #7
Riparian zones need trees to shade fish.

WINDOW #8
Riparian zones prevent too much erosion from clogging rivers and streams.

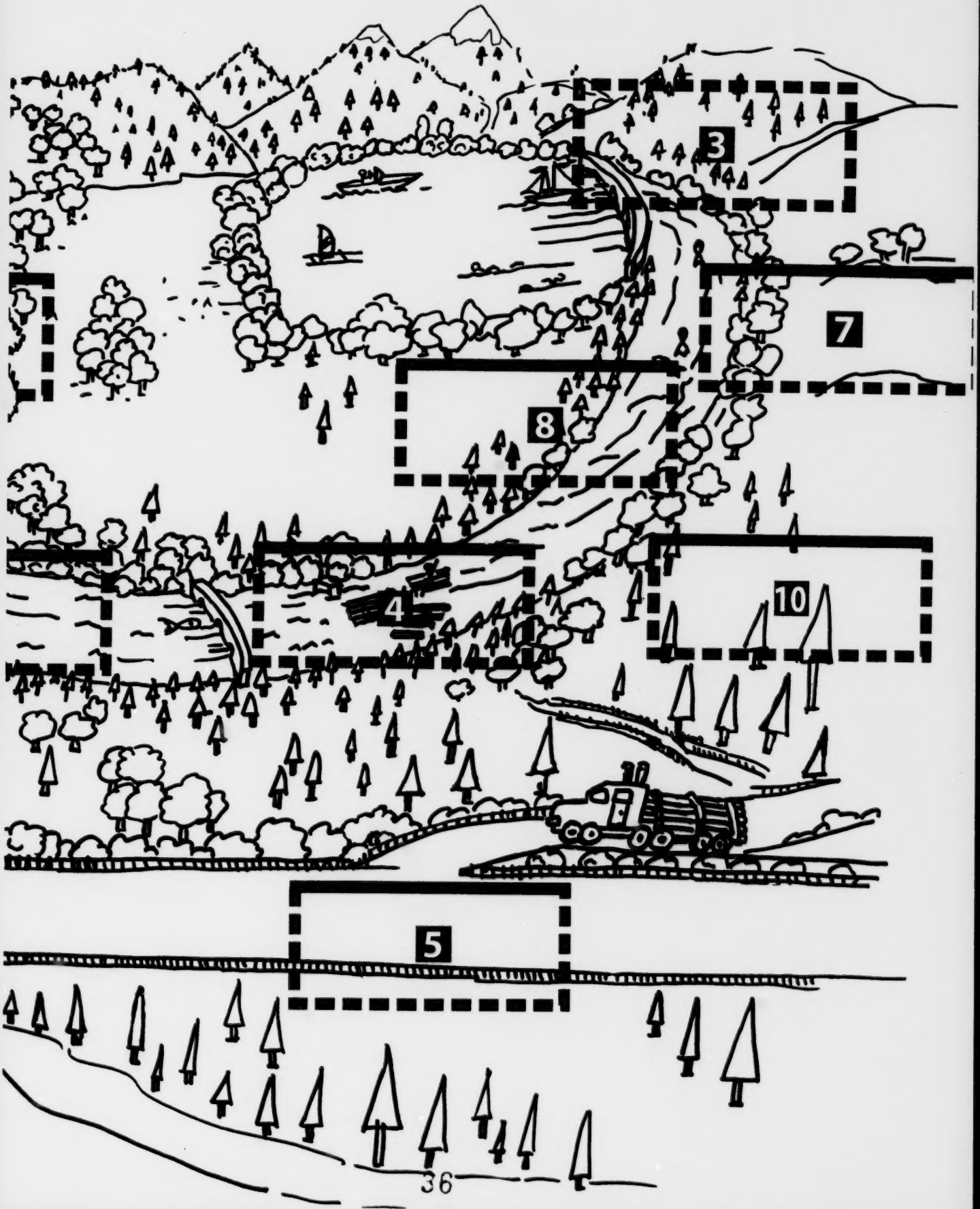
WINDOW #9
Any harvest that is permitted on private land must protect wildlife, plants, and their habitat.

WINDOW #10
Openings made by timber harvesting must only be 20 acres or less.



FOREST

Panorama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FOREST Management

Any harvest that is permitted on private land must protect wildlife, plants, and their habitat.

Areas may not be harvested near archeological sites, such as those areas containing Native American relics.

Some salmon are in trouble because they have been overfished.

Trees may not be harvested along either side of a waterway. These areas are called riparian zones.

Dams and hydroelectric plants block salmon waterways so they can't reach their spawning grounds.

Riparian zones need trees to shade fis

Riparian zones prevent too much erosion from clogging rivers and streams.

Old methods of logging once blocked streams. Now foresters and others work to help salmon increase their numbers.

Openings made by timber harvesting must be only 20 acres or less.

Forest roads must be built carefully in order to prevent erosion.

Did You Know?...

Name _____

Read the information and questions below then write your answers on the back of this sheet.

1. Did you know that California's foresters never harvest more than is already growing elsewhere in the forest? This is called sustainable forestry. Can you guess what sustainable means?

2. Did you know that the harvesting of trees on private land is carefully monitored in California? The California Forest Practices Act is the most important of the laws that help regulate how the forest is maintained. It tells foresters what they must do before they may harvest. It tells them how harvesting should be done, and it tells them how and when they should replant. Replanting is called reforestation. What do you think the "re" in each word means? Can you think of any other "re" words?

3. Did you know that California law requires foresters to plant many more trees than are harvested on every acre of productive forestland? What is the difference between private forestland and public forestland?

4. Did you know that California foresters replant harvested areas with seedlings that come from seeds gathered from that same location? Only the strongest and best seedlings are used for replanting. What is the difference between a seedling and a seed? What is the difference between a seedling and a sapling? What is the difference between a sapling and a tree?

5. Did you know that eight out of every ten trees that are planted grow to be adult trees. What happens to the other two?

Answer Key

DID YOU KNOW?...

1. Did you know that California's foresters never harvest more than is already growing elsewhere in the forest? This is called sustainable forestry. Can you guess what sustainable means?

Answer:
It means to keep something in existence; to keep it available; to keep the same amount

2. Did you know that the harvesting of trees on private land is carefully monitored in California? The California Forest Practices Act is the most important of the laws that help regulate how the forest is maintained. It tells foresters what they must do before they may harvest. It tells them how harvesting should be done, and it tells them how and when they should replant. Replanting is called reforestation. What do you think the "re" in each word means? Can you think of any other "re" words?

Answer:
It means "again".
Renew, review, reestablish, retrain, remodel

3. Did you know that California law requires foresters to plant many more trees than are harvested on every acre of productive forestland? What is the difference between private forestland and public forestland?

Answer:
Private forest land is owned by private individuals, such as Christmas tree farmers, forest products companies, resort companies, and ordinary citizens. Public lands are owned by the state or federal government.

4. Did you know that California foresters replant harvested areas with seedlings that come from seeds gathered from that same location? Only the strongest and best seedlings are used for replanting. What is the difference between a seedling and a seed? What is the difference between a seedling and a sapling? What is the difference between a sapling and a tree?

Answer:
A tree is a woody plant with one main stem or trunk. It may have several branches. It may lose its leaves or stay evergreen. Its seeds come from fruits, nuts, or cones. The seed provides nutrients (food) for the young tree as it first begins to grow. A seedling is what sprouts from the seed. It is the youngest form of a tree. A sapling is a very young, slender tree.

5. Did you know that eight out of every ten trees that are planted grow to be adult trees. What happens to the other two?

Answer:
- *Animals, like deer, eat some of the seedlings.*
- *Insects attack some of the young trees.*
- *Fire destroys some of them.*
- *Some do not get enough water or sunlight.*

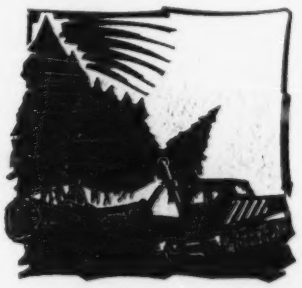
Lesson 5
Forest Health

Objectives:

1. To understand how overcrowding makes trees vulnerable to insects, disease, and wildfires
2. To understand that enlightened management using sustained forestry, controlled burns, and thinning provides forest health and ensures that California will never grow out of trees

Skills:

1. Critical Reasoning
2. Forestry
3. Ecology
4. Association



Vocabulary:

VOCABULARY

1. **Wildfire** - a fire that is burning out of control and unpredictably
2. **Habitat** - the place that is home to a plant or animal
3. **Conifer** - a cone-bearing evergreen tree.
4. **By-product** - something that is made in the process of making something else
5. **Cambium** - clusters of tree cells that produce new layers of bark each year forming the tree rings that we can count to tell the age of a tree
6. **Natural regeneration** - the process by which seeds sprout to produce seedlings in the wild, without the use of a nursery to cultivate them

Focus:

1. Establish the concept of competition as an element of all forms of life by asking the students to guess what happens if a tree has too many fruits on it.

   Many of them will be weak and small.

   They are more likely to be attacked by insects and diseases.

   Many will fall from the tree before they ripen.

2. Establish the concept of the forest as a large garden. Gardens that are healthy, beautiful, and productive need to have plenty of water, fertile soil, protection against insects and diseases, and thinning of overcrowded plants. If they remain overcrowded, there is too much competition for nutrients, water, and sunlight. They soon become stressed and vulnerable. Thinnings in the garden can be used as food or as fertilizer in a compost pile. Thinnings in the forest are harvested trees used for forest products or to produce energy in cogeneration plants.

3. Establish the concept of sustainable forestry by asking the students to figure out a plan by which they can keep picking flowers from their garden all year.

   They can replant new flowers as others are being harvested.

4. Establish the concept of checks and balances in nature by asking the students to come up with ways in which the forest is kept from being overcrowded and becoming weak and unhealthy.

   Insects, diseases, natural and controlled fires, and thinning help keep a natural balance in the forest.

5. Use the FOREST FACTS DISCUSSION THEMES to reinforce key forestry concepts before students initiate the other activity sheets.

Enrichment Activities:

1. Have students decode the message to discover the three basic ENEMIES OF THE FOREST.
2. Have students work THE PUZZLE BOX to find out why California will never grow out of trees.
3. Have the students decrypt A FOREST PUZZLE to find out what two procedures can help maintain forest health.

Answer Key

FOREST FACTS

1. One hundred years ago, California forests were more "open" than they are today. What does that mean?

Answer:
The forest was not as dense.

2. In some places, where there used to be twenty trees per acre of land, now there are more than three hundred trees. How healthy do you think those three hundred trees are? What could you do to make them healthier?

Answer:
Overcrowded trees are stressed from too much competition. To make them healthier, they should be thinned by careful harvesting and controlled burns to remove brush.

3. Overcrowding in the forest makes trees unhealthy. They have to compete too heavily for sun, food, and water. This competition weakens them. They cannot resist wildfires, insects, and disease. What does competition mean? Can you think of other examples where too much competition is unhealthy?

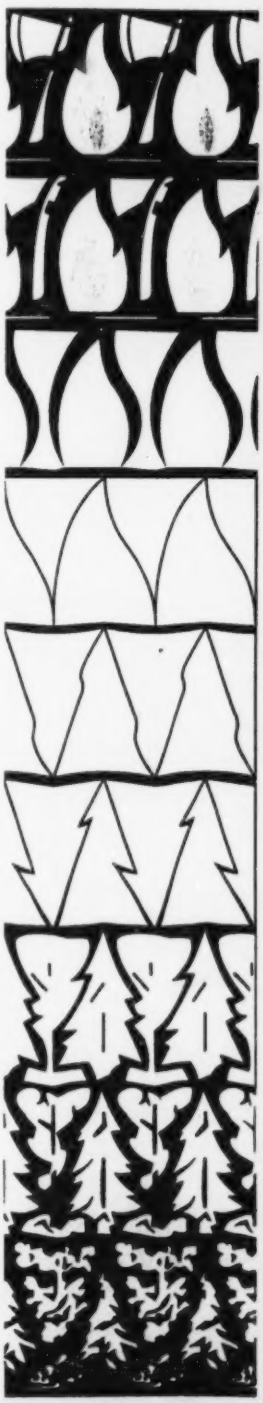
Answer:
- *Competition is when two or more persons or things try to get the same object.*
- *Too much competition between friends or family members can cause hard feelings.*
- *Too much competition in the classroom for grades makes a student lose sight of what is truly important – the learning going on.*

4. Dead and dying trees produce great amounts of fuel which feed wildfires. These fires rage out of control and are hard to stop. Describe what happens in a wildfire to all the elements of this ecological community.

Answer:
- *Animals and people are forced to leave the area or are injured.*
- *Many plants and trees are destroyed.*
- *People having homes or businesses in the forest may lose them.*
- *Millions of dollars are lost in fighting wildfires.*

5. Raging wildfires get so hot that they bake the "biota" out of the soil. If "bio" means life, what do you guess "biota" means? What other "bio" words can you think of?

Answer:
- *Biota - living things*
- *Biology - the study of living things*
- *Bionic - life like*
- *Biography - the writing about someone's life*



Forest Facts

Name _____

Read the information and questions below then write your answers on the back of this sheet.

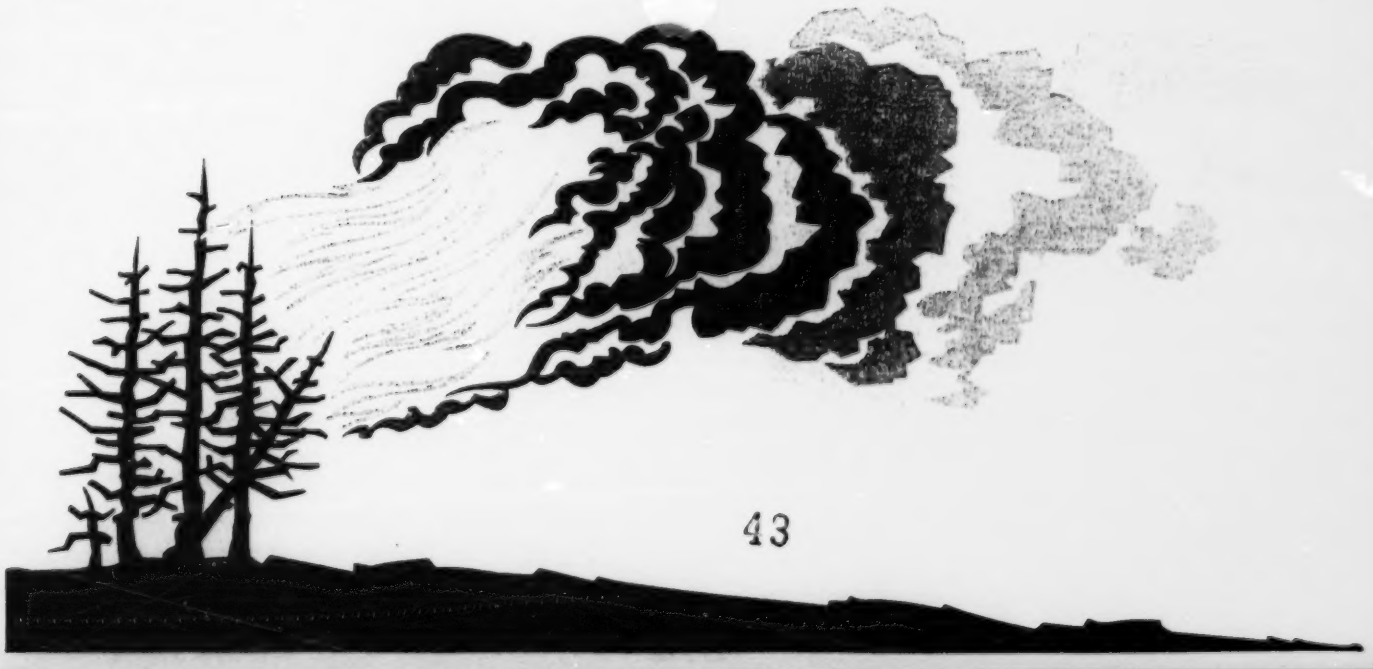
1. One hundred years ago, California forests were more "open" than they are today. What does that mean?

2. In some places, where there used to be twenty trees per acre of land, now there are more than three hundred trees. How healthy do you think those three hundred trees are? What could you do to make them healthier?

3. Overcrowding in the forest makes trees unhealthy. They have to compete too heavily for sun, food, and water. This competition weakens them. They cannot resist wildfires, insects, and disease. What does competition mean? Can you think of other examples where too much competition is unhealthy?

4. Dead and dying trees produce great amounts of fuel which feed wildfires. These fires rage out of control and are hard to stop. Describe what happens in a wildfire to all the elements of this ecological community.

5. Raging wildfires get so hot that they bake the "biota" out of the soil. If "bio" means life, what do you think "biota" means? What other "bio" words can you think of?

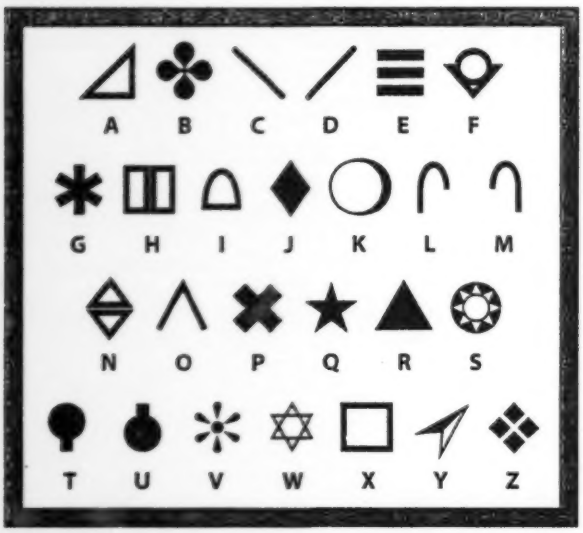


Enemies of the Forest

Name _____

Use the key to unlock the message. The answer is hidden somewhere on the page.

Letter Key



44

A Forest Puzzle

Name _____

What two forest management methods help keep California's forests healthy? To find out, follow the directions and work the puzzle below.

DIRECTIONS:

1st Write the words that fit the definitions in Section A.

2nd Match the letters and numbers from Section A with the letters and numbers of Section B.

3rd To help you get started, we've filled in one letter in each word of Section A and B.

Section A

1. The place that is home to a plant or an animal is called:

			I			
13	14	10	4	11	14	11

2. Because it makes cones, we call evergreen trees:

C							
1	2	3	4	5	6	7	8

3. Cones make these from which new trees will sprout:

			D	
8	6	6	9	8

4. These insects eat a circle around a tree which prevents food and water from reaching all parts of the tree:

			T			
10	6	6	11	12	6	8

5. A wood by-product that is a sticky substance from which many forest products are made is called:

		G			
12	4	17	3	4	3

6. Thanks to this part of a tree, we can count the rings to tell the age of the tree.

						M
1	14	15	10	4	16	15

Section B

These can help keep the forest healthy.

	H						
11	13	4	3	3	4	3	17

	N	
14	3	9

								E	
1	2	3	11	7	2	12	12	6	9

B				
10	16	7	3	8

Answer Key

A FOREST PUZZLE

Section A

1. The place that is home to a plant or an animal is called:

H	A	B	I	T	A	T
13	14	10	4	11	14	11

2. Because it makes cones, we call evergreen trees:

C	O	N	I	F	E	R	S
1	2	3	4	5	6	7	8

3. Cones make these from which new trees will sprout:

S	E	E	D	S
8	6	6	9	8

4. These insects eat a circle around a tree which prevents food and water from reaching all parts of the tree:

B	E	E	T	L	E	S
10	6	6	11	12	6	8

5. A wood by-product that is a sticky substance from which many forest products are made is called:

L	I	G	N	I	N
12	4	17	3	4	3

6. Thanks to this part of a tree, we can count the rings to tell the age of the tree.

C	A	M	B	I	U	M
1	14	15	10	4	16	15

Section B

These can help keep the forest healthy.

T	H	I	N	N	I	N	G
11	13	4	3	3	4	3	17

A	N	D
14	3	9

C	O	N	T	R	O	L	L	E	D
1	2	3	11	7	2	12	12	6	9

B	U	R	N	S
10	16	7	3	8

PUZZLE BOX

Name _____

To uncover the secret ending to the message below, you will need to work with both the message box and the puzzle box.

Below each letter in the message box you will find two numbers. Find the first number of each set along the left side of the puzzle box. Find the second number along the bottom of the puzzle box.

If you move your left finger from the first number toward the right along its grid line, and you move your right finger toward the top along its grid line, you will end up with both fingers in the same square. The letter you find in that square can now be put in the message box.

Two letters have already been filled in for you to help you get started. Can you retrace how we found them?

Message:

California will never grow out of trees because foresters practice...

Puzzle Box

	6	7	8	9	10
1	E	G	L	W	J
2	P	A	R	D	T
3	B	M	O	X	F
4	H	C	Q	U	N
5	V	S	K	Y	I

Message Box

			T							
5/7	4/9	5/7	2/10	2/7	5/10	4/10	2/7	3/6	1/8	1/6

							Y
3/10	3/8	2/8	1/6	5/7	2/10	2/8	5/9

Answer Key

PUZZLE BOX

Message:

California will never grow out of trees because foresters practice...

Puzzle Box

	6	7	8	9	10
1	E	G	L	W	J
2	P	A	R	D	T
3	B	M	O	X	F
4	H	C	Q	U	N
5	V	S	K	Y	I

Message Box

S	U	S	T	A	I	N	A	B	L	E
5/7	4/9	5/7	2/10	2/7	5/10	4/10	2/7	3/6	1/8	1/6

F	O	R	E	S	T	R	Y
3/10	3/8	2/8	1/6	5/7	2/10	2/8	5/9

Lesson 6

Waste Not-Want Not

Objectives:

1. To understand and appreciate the value of our natural resources
2. To understand the value of responsible choices in protecting our natural resources
3. To understand the stresses that a vast population places on natural resources
4. To understand that wise use of wood—nature's only renewable, recyclable, energy efficient, and biodegradable resource—lessens the stress on all our other natural resources
5. To understand that each of us has choices to make in how to use natural resources - It is up to us not to waste what we have and to make sure that what we use is renewable, whenever possible.

✓Skills:

1. Consumer Awareness
2. Ecology
3. Natural Science
4. History
5. Reading
6. Association

Vocabulary:

1. **Renewable** - having the capability of replenishing itself
2. **Recyclable** - being able to be utilized again, often by being restructured into something else
3. **Biodegradable** - being able to be broken down or decomposed by natural means
4. **Natural Resources** - things we use that come from the earth
5. **Landfills** - places in our communities where garbage is unloaded and then covered over with dirt and packed down
6. **Decay** - the coming apart or rotting of organic material
7. **Decompose** - to decay or come apart
8. **Organic** - material made of carbon; made of living matter
9. **Compost** - a collection of organic scraps and garbage that decays and becomes good fertilizer

VOCABULARY

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Focus:

1. Establish the concept of individual responsibility by discussing with the students what are some natural resources. See the examples below:

- **minerals, water, trees, ores**

What are people in the cities and in the countryside doing to protect natural resources?

- **Being careful not to waste water**
- **Buying things that can be recycled**
- **Recycling at home**
- **Conserving energy at home by turning out lights when not in a room**
- **Raising the thermostat during the summer**
- **Lowering the thermostat in winter**
- **Planting trees that lose their leaves in autumn so they will give shade in summer and let the sun through in winter**
- **Insulating the house well**

What are the students in the class, along with their families, doing to protect our natural resources?

- **Recycling in the classroom and at work**
- **Planting trees on the school grounds**
- **Using both sides of the paper**
- **Sharing books and other resources**

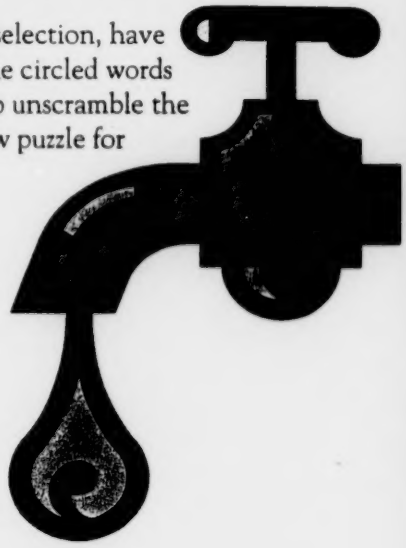
How does Mother Nature recycle?

By decomposing things that have died or come apart

2. Have the students read the selection "Waste Not - Want Not" to establish the concept of responsible usage and disposal of things in our society. Preface the reading by asking them to guess what the title means. To what does it refer?

In Colonial times this was a way of saying that if we don't waste things that we have, they will be there for us when we need them.

3. After reading the selection, have the students use the circled words in the story to help unscramble the words in the review puzzle for Lesson 6.



Answer Key

ENVIRONMENTAL ANAGRAM

1. CCYEELRD - **RECYCLED**

2. UREESD - **RE-USED**

3. NWBERELAE - **RENEWABLE**

4. IODBBEGARLDAE - **BIODEGRADABLE**

5. DLLSALNIF - **LANDFILLS**

6. MCTOOPS - **COMPOST**

7. YDEAC - **DECAY**

8. GORACIN - **ORGANIC**

9. CEDOPMSOE - **DECOMPOSE**

10. SITRESBILIPONY - **RESPONSIBILITY**

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Waste Not-Want Not

Name _____

First read the story. Then use the circled words to decode the Environmental Anagram.

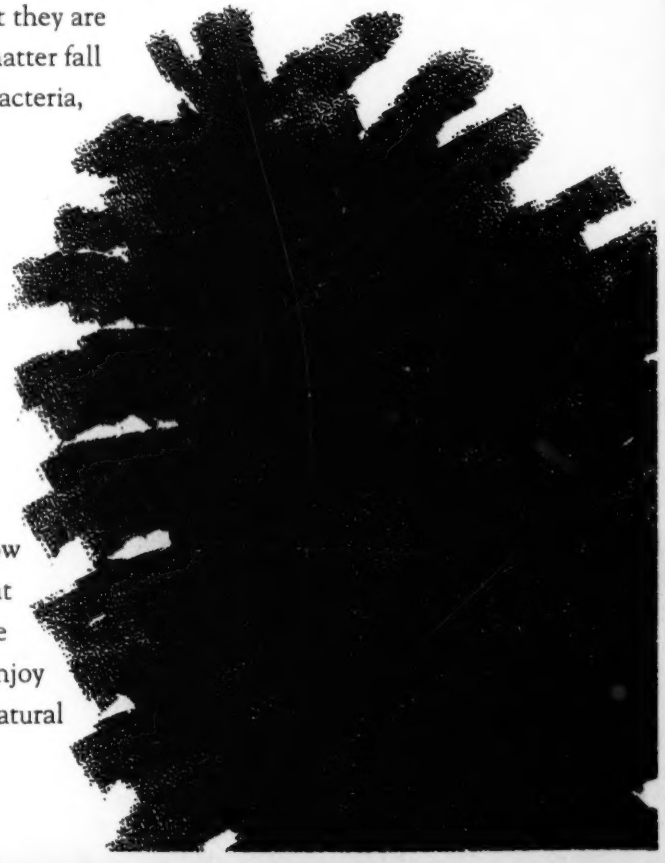
America is blessed with many natural resources. These are things that nature provides for our use and enjoyment. The forest is one of our major natural resources. We are lucky to have a great many forests and trees, but we need to be careful how we use them.

In America, we use more paper than anywhere else in the world. Each of us uses almost 700 pounds of paper a year. Where does it all go? You guessed it--landfills. About four out of every ten solid things put into landfills are made of paper, and most of that is newspapers.

Luckily, Americans know they must show responsibility by making wise choices to protect our natural resources. One way is by recycling. We have learned that many products can be recycled to make other items. About a quarter of all the paper that is made in the U.S. today is made from re-used paper.

Americans have also learned that if we make things from a resource that is renewable, like trees, that resource will grow back. It will be available to use again and again. Things made out of ores, such as steel or aluminum, or out of petroleum products, like plastics, are not renewable. Once the ores or petroleum sources are used up, they are gone forever. Most of these products are also not biodegradable.

Even Mother Nature recycles. Pine needles, cones, leaves, dead trees and plants may seem like useless forest waste, but they are really important to the forest. These bits of organic matter fall to the ground. With the help of sunlight, air, water, bacteria, worms, and insects forest waste begins to decay and decompose. As it breaks down, the waste acts as a fertilizer to help trees and other plants grow. Forest waste holds the soil together to prevent erosion.



People now imitate Mother Nature. Many farmers and gardeners stack organic matter together to form a compost pile. In this pile, food and garden scraps will decay and produce fertilizer just like forest litter does in the woods.

Our natural resources are a wonderful gift. We need to use them wisely. Each of us should try to follow the "*Three Rs*" whenever possible. Can you guess what they are? Renew, Recycle, and Responsible Use. If we follow those simple guidelines, we all will be able to enjoy Nature's Treasure Chest and still make sure that our natural resources are available today, tomorrow, and forever.

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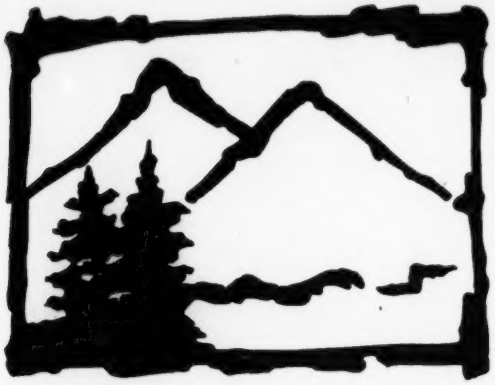


All of the words below deal with protecting and preserving our natural resources. Unscramble them using the circled words in the story as your guide.

Environmental ANAGRAM

1. CCYEELRD _____

2. UREESD _____

3. NWBERELAE _____

4. IODBBEGARLDAE _____

5. DLLSALNIF _____

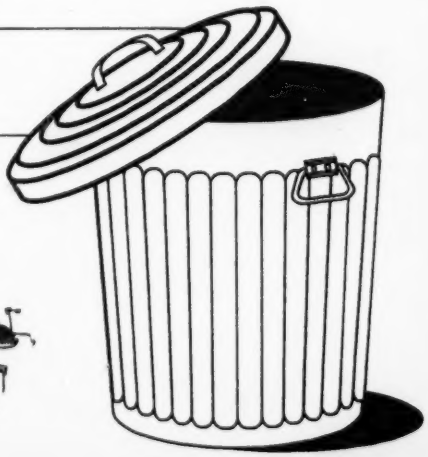
6. MCTOOPS _____

7. YDEAC _____

8. GORACIN _____

9 CEDOPMSOE _____

10 SITRESBILIPONY _____



Lesson 7

Forest Families

Objectives:

1. To reinforce the material presented in Lessons 1-6
2. To provide an entertaining activity that allows for enrichment and expansion of information on the forest

Skills:

1. Art
2. Ecology
3. Botany
4. Government
5. Logic
6. Classification

Vocabulary:

Review the vocabulary from Lessons 1-6

VOCABULARY

Focus:

1. There are 36 cards in each deck, 6 **Forest Families** with 6 members in each.
2. Copy enough decks so that students can play in groups of four to six per deck.
3. Have the students work in groups to cut apart the individual components of the game, **Forest Families**.
4. If the cards have been duplicated on regular paper, they will need to be pasted onto index cards and trimmed to fit.
5. Duplicating onto cardstock will eliminate the need for backing.
   CAUTION: *If using colored index cards or cardstock, make sure all of the cards in a deck are of the same color!*
6. For long term use, laminating or covering with clear contact paper is recommended.
7. *Normal play:* The dealer hands out all the cards among four players (9 cards each) or six players (6 cards each)
8. *Alternate play:* For 3 or 5 players, the dealer should only hand out 5 cards to each player and place the rest of the cards in a draw pile. As the game progresses and a player loses his turn, he will draw from the pile and then discard a card from his own hand.

It is not recommended that the game be played with less than 3 players.

FOREST FAMILIES:

Directions & Rules

Objectives:

To collect **Forest Families** *sets*
The player with the most number of sets is the winner.

Rules:

1. The dealer shuffles the cards then passes them all out, face down, to all the players (If playing with 3 or 5, see the suggestions for alternate play.)

2. Players organize their hand in sets made from the **Forest Families** that they were dealt.

3. The player to the right of the dealer begins the play. This "lead" player chooses a "target" player to question in order to collect more cards to add to the partial sets he already has in his hand.

4. The first question on every player's turn is always to find out whether the target player has cards in a particular forest family that the lead player wishes to collect.

   Example: "Tommy, do you have Parts of a Tree family?" If Tommy doesn't have one of the cards in that set, he answers "No." The first player then loses his turn.

5. If Tommy does have one or more in the chosen category, he answers the lead player, "Yes, I do." He should not tell which card or cards he has. The lead player then can ask a question about a particular member of that family.

   Example: "Tommy, do you have the Sapwood? If Tommy doesn't have that particular card, the first player loses his turn. If Tommy has that card, he must hand over the card, and the first player gets to continue with his turn. He can now ask Tommy or another player about a forest family of his choice. The forest family may be a different one, or it may be in the same family he was collecting before.

6. Players take turns asking questions as they try to collect all the cards in a particular family until all the cards in the deck are collected in sets by the different players in that group.

7. Additional information about members of **Forest Families** are on each card to allow players to review and add to what they have learned in the previous lessons.

54

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Workers of the Forest

Workers of the Forest

GEOLOGIST

1. A geologist is an earth scientist.
2. Geologists make certain that when trees are harvested there won't be landslides or erosion problems.
3. Geologists work with a RPF to produce a timber harvest plan.

Workers of the Forest

HYDROLOGIST

1. A hydrologist is a water scientist.
2. Hydrologists protect rivers, streams, and other bodies of water during harvesting.
3. Hydrologists work with a RPF on timber harvest plans.

Workers of the Forest

BOTANIST

1. A botanist is a plant scientist.
2. Botanists protect all forms of plant life as an area is harvested.
3. Botanists work with a RPF to plan for replanting after harvesting.

Workers of the Forest

R. P. F.

1. In California, a registered professional forester is the only person allowed to write a timber harvest plan.
2. A RPF checks with other forest specialists about where trees can be harvested, how harvesting is to be done, and what rules have to be followed to protect the forest.
3. Like a doctor or a lawyer, a RPF must first pass a very comprehensive test in order to get a license.

Workers of the Forest

WILDLIFE BIOLOGIST

1. Makes sure that when trees are harvested animals that live in the forest are protected.
2. Checks to see that animals have plenty of places to find food, hide, and take care of their young.
3. Works with a RPF to produce a timber harvest plan.

Workers of the Forest

FISHERIES BIOLOGIST

1. Checks to see that during harvesting water will be kept clean.
2. Checks to see that fish will have many places in which to live and reproduce.
3. Works with a RPF to produce a timber harvest plan.

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Forest Safeguards

Forest Safeguards

TIMBER HARVEST PLAN

1. Before a landowner in California can harvest timber, a written timber harvest plan must be approved by the Department of Forestry and Fire Protection.
2. A timber harvest plan describes in detail how the harvest will be done, how the area will be replanted, and what will be done to prevent erosion, keep water pure, and protect habitat.
3. A timber harvest plan can only be written by a registered professional forester.

Forest Safeguards

CLEAN WATER ACT

1. The Clean Water Act protects against watershed erosion that might clog rivers and streams.
2. The CWA regulates areas around city and county water supplies to maintain water quality.
3. About 85% of California's water comes from the forests by means of creeks, streams, and rivers.

Forest Safeguards

FOREST PRACTICES ACT

1. Controls all harvest-related activities on private lands in the state.
2. The California Forest Practices Act is the most comprehensive regulation in the nation.
3. It encourages private forest landowners to do whatever is necessary to protect and improve forest health.

Forest Safeguards

CONTROLLED BURNS

1. Controlled fires are usually set during the rainy season, when they can be more easily regulated.
2. Controlled burns reduce the amount of brush and debris on the ground.
3. California Native Americans set fires to open up the forests for crops, to make it easier to hunt, and to protect their villages.

Forest Safeguards

MANAGED THINNING

1. Thinning protects the forest by preventing overcrowding.
2. Thinned trees can be chipped for use by pulp and paper mills.
3. Thinned trees can be used as fuel to produce electricity at biomass power plants.

Forest Safeguards

SUSTAINED YIELD HARVESTING

1. Sustained yield means never harvesting more wood than the forest is currently growing.
2. California foresters plant 20-30 million seedlings every year!
3. Sustained yield harvesting provides the forest products we need and also makes sure that California's forests will be here today, tomorrow, and forever.

Types of Trees

Types of Trees

DOUGLAS-FIR

1. It has small, bristly cones.
2. It has short, blunt needles.
3. It grows along the coast and inland areas of California.

Types of Trees

WHITE FIR

1. It has blue-green needles.
2. It has beehive-looking olive-green or purple cones.
3. It grows at higher elevations.

Types of Trees

SUGAR PINE

1. It grows to 200 feet!
2. It has long, thin needles.
3. It has huge pine cones.

Types of Trees

REDWOOD

1. It has short, flat needles.
2. It is found along the coast.
3. Its cone is the size of a large button.

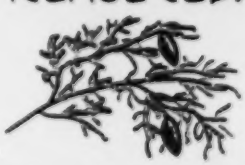
Types of Trees

PONDEROSA PINE

1. It has long, dark yellow-green needles.
2. It grows to 180 feet tall.
3. It is common in the West, especially in the Sierras of California.

Types of Trees

INCENSE CEDAR



1. Its branches are flattened with short, overlapping scales.
2. It grows along the western slopes of the Sierras.
3. Its strong, fragrant oils help make it insect and decay resistant.

Forest Products

Forest Products

ENERGY

1. Wood is the only natural resource that is renewable, recyclable, and biodegradable.
2. Products made from fossil fuels, like coal and petroleum, are not renewable.
3. Wood scraps are burned at very high temperatures to provide the electricity needed to power our machines.

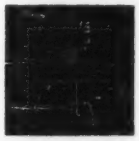
Forest Products

PAPER PRODUCTS

1. Machines at paper mills filter leftover paper-making ingredients to keep water clean.
2. Vacuums at paper mills filter out 99.9% of pollutants from the air.
3. Oxygen is added to the water around paper mills so that plants and fish stay healthy.

Forest Products

BUILDING MATERIALS



1. At the mill, lumber is stacked and left to dry out. This drying is called "seasoning".
2. Fresh wood has a lot of moisture in it. If it is not "seasoned", it may warp later on.
3. If lumber is too dry, it may crack.

Forest Products

RECREATION

1. National forests in California cover an area larger than the state of South Carolina.
2. Roads built by forest products companies make it easy to get to campsites, ski areas, and trailheads.
3. California has more than 300 state parks, 7 national parks, and 4 million acres of wilderness. National forests of California offer 13,000 miles of fishing rivers, 10,000 miles of trails, 2,400 lakes and reservoirs, and 22 major ski areas.

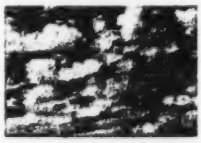
Forest Products

ANIMAL HABITAT

1. California forests are home to almost 650 species of fish and wildlife.
2. Strict state and federal laws require that forest products companies protect not just wildlife but also their habitat.
3. The word "habitat" comes from the Latin word for "home".

Forest Products

CLEAN AIR AND WATER



1. Forests are oxygen factories. An acre of trees that grows 4,000 pounds of wood also produces 4, 280 pounds of oxygen for us to breathe.
2. When forests get overcrowded, they quit growing. Trees then start to use oxygen instead of producing it.
3. Water that trees add to the air is important for rainfall patterns.

Natural Enemies of the Forest

Natural Enemies of the Forest

VOLCANOES

1. They cause forest fires when burning lava covers forests.
2. Mount St. Helens destroyed forests up to 20 miles from its mouth.
3. The wood destroyed could make a board that reaches to the moon and back and wraps around the earth ten more times.

Natural Enemies of the Forest

WINDS

1. Hurricanes are powerful enough to destroy a whole forest.
2. Large trees in overcrowded stands are often uprooted by severe storms because of their size and weak condition.
3. Our word "hurricane" comes from the Arawak word "Jurakan", meaning a bad and destructive spirit.

Natural Enemies of the Forest

WILDFIRES

1. Wildfires often get so hot that they bake the soil and destroy all the biota in it.
2. Only 10% of all wildfires in California are started by lightning. The rest are man-made.
3. Controlled burns imitate Mother Nature by preventing the unhealthy effects of overcrowding.

Natural Enemies of the Forest

INSECTS

1. Bark beetles eat a circle around a tree and prevent nutrients and water from reaching all parts of the tree.
2. Insects can more easily attack and destroy trees that are stressed from overcrowding.
3. Insects do more damage than forest fires and diseases put together.

Natural Enemies of the Forest

DISEASE

1. A fungus takes nutrients away from the tree's cells.
2. Mistletoe and Dutch elm disease are examples of diseases.
3. Overcrowded trees are stressed and are more likely to be attacked by fungus and other diseases.

Natural Enemies of the Forest

STRESS

1. Competition for nutrients and water in overcrowded forests causes trees to become stressed.
2. Stressed trees are more likely to be killed or harmed by diseases, insects, drought, and violent acts of nature.
3. Overcrowded trees do not make good homes for most wildlife because their shade prevents the growth of ground plants that animals need.

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Parts of a Trees

Parts of a Tree

ROOTS

1. Most trees have very large root systems.
2. Roots draw water and nutrients from below ground to cause growth above ground.
3. Because of root growth, the tree may be almost as large below the ground as above it.

Parts of a Tree

LEAVES/NEEDLES

1. Once they sprout, trees make their own food in their leaves or needles.
2. Chlorophyll is the substance that gives needles and leaves their green color.
3. Needles and leaves convert energy from the sun, water drawn from their roots, and carbon dioxide from the air to produce the sugars they use for "food".

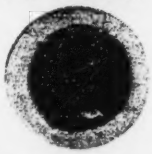
Parts of a Tree

BARK

1. Outer bark protects the tree from weather, insects, disease, fire, and animals.
2. Inner bark carries nutrients down from the leaves to the branches, the trunk, and the roots for growth.
3. Bark can be thick or thin: birch bark may be 1/4 of an inch thick; giant sequoia bark may be 2 feet thick.

Parts of a Tree

CAMBIUM



1. Cambium is made up of layers of cells that divide and grow, producing new layers of wood.
2. These layers of cells allow us to "read the rings" to tell a tree's age.
3. A dark ring and a light ring are produced each spring and summer. We count the dark rings to tell a tree's age.

Parts of a Tree

SAPWOOD

1. Sapwood transports minerals and water from the roots to the crown of the tree.
2. Sugars move down the sapwood from the leaves to feed the roots.
3. Chemicals in the sap determine the color the leaves turn in the fall.

Parts of a Tree

SEED

1. Seeds carry the beginnings of life for a tree and also its food supply.
2. Seeds can be found in cones, nuts, or fruits.
3. Seeds fall in the autumn and are covered with a blanket of needles and leaves for the winter. They then sprout in the spring.

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Additional Resources

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